E.X.D.

VOLUME LXXXII NUMBER 2

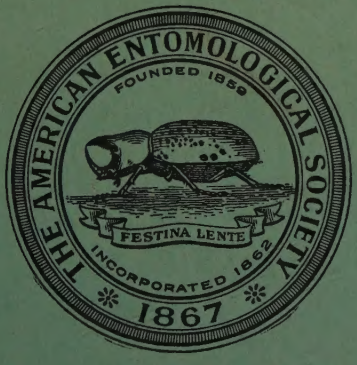
JUNE, 1956

R
COMMONWEALTH INST. OF ENTOMOLOGY LIBRARY
- 5 NOV 1956
SERIAL U.S.A. 36
SEPARATE

TRANSACTIONS

OF THE

AMERICAN ENTOMOLOGICAL SOCIETY



PUBLISHED BY THE AMERICAN ENTOMOLOGICAL SOCIETY AT

THE ACADEMY OF NATURAL SCIENCES

PHILADELPHIA

THE AMERICAN ENTOMOLOGICAL SOCIETY

PHILADELPHIA

Founded 1859 — Incorporated 1862

Organized as "The Entomological Society of Philadelphia," the present title was adopted February 11, 1867.

PRESIDENT
Fred E. Jacobson

VICE-PRESIDENT
Harry W. Allen

CORRESPONDING SECRETARY
Marvin W. Brunson

TREASURER
James A. G. Rehn

RECORDING SECRETARY
Harold J. Grant, Jr.

FINANCE COMMITTEE
George S. Rigby — Carl Fenninger
Edward Marx — James A. G. Rehn

PUBLICATION COMMITTEE
James A. G. Rehn — R. G. Schmieder
Harry W. Allen — Maurice E. Phillips (*Editor*)

Stated meetings are held in January, February, March, April, May, September, October, November and December. The offices, meeting-room, and collections of the Society are in the Entomological Department of The Academy of Natural Sciences of Philadelphia.

SERIAL PUBLICATIONS OF THE SOCIETY

Proceedings of The Entomological Society of Philadelphia, volumes I–VI, 1861–1867. Out of print and cannot be supplied.

Transactions of The American Entomological Society, volumes I–IV, out of print and cannot be supplied; V–date, price on application. Published in annual volumes of quarterly numbers. Subscription price $6.00 per volume.

The Practical Entomologist, volumes I–II, 1865–1867. Price $5.00 for the two volumes.

Memoirs of The American Entomological Society, No. 1, 1916, price $3.00; No. 2, 1917, price $5.50; No. 3, 1919, price $2.00; No. 4, 1920, price $3.00; No. 5, 1928, price $2.00; No. 6, 1929, price $2.00; No. 7, 1930, price $4.50; No. 8, 1934, price $2.50; No. 9, 1937, price $2.50; No. 10, 1941, price $3.00; No. 11, 1944, price $15.00; No. 12, 1946, price $5.00; No. 13, 1948, price $4.50; No. 14, 1951, price $5.00.

Entomological News, volumes I–LXVI; many out of print. Subscription price, domestic, $5.00 per annual volume.

Various irregular, non-serial publications have been issued, which may be found in our price list under their respective authors.

To establish the date of issue, each paper, as soon as completed, is placed on sale and a copy of it is mailed to each the following institutions, with a request that it be placed in their library for reference.

Entomological Society of London
Entomological Society of Ontario
American Museum of Natural History
Museum of Comparative Zoology
Transvaal Museum
California Academy of Sciences
Instituto Oswaldo Cruz
Smithsonian Institution
Sociedad Entomologica Argentina
Australian Museum

Separates of papers published in the Proceedings and Transactions, if in stock, can be supplied at prices given in our price lists. Detailed information supplied upon request.

In sending subscriptions or in making inquiries relative to publications, address:

THE AMERICAN ENTOMOLOGICAL SOCIETY,
The Academy of Natural Sciences, Philadelphia, Pa.

STUDIES ON THE LARVAE OF DIGGER WASPS (HYMENOPTERA, SPHECIDAE) PART II: NYSSONINAE[1]

BY HOWARD E. EVANS AND CHENG SHAN LIN
Cornell University, Ithaca, N. Y.

(Plates II to XIV)

The Nyssoninae are one of the largest subfamilies of sphecid wasps. The recent Synoptic Catalog (1951, U. S. Dept. Agri., Monogr. no. 2, pp. 980–1000) recognizes 29 genera which are arranged in six tribes. Our representation of genera within this subfamily is not as great as might be desired. In the Alyssonini, we have representatives of one of the two genera; in the Nyssonini, one of four; in the Gorytini, four of 13; in the Stizini, one of three; and in the Bembicini, six of six. Nevertheless, we feel that this is sufficient to present at least some preliminary conclusions regarding tribal characters and, in the Bembicini, regarding generic and some specific characters. That portion of this paper dealing with the Bembicini formed part of a doctor's thesis at Cornell University for the junior author.

The reader is referred to Part I of this series (1956, Trans. Amer. Ent. Soc., 81: 131-153) for a discussion of techniques and terminology. We prefer to postpone a general discussion of phylogeny and evolution until the concluding paper of this series. However, it has seemed desirable to present in this section a few preliminary remarks on the classification of the Nyssoninae as indicated by larval characters, inasmuch as the senior author plans to publish considerable ethological data on the group in the near future.

[1] Many of the larvae here described were collected in the course of a research project on the comparative behavior of solitary wasps, supported by a grant from the National Science Foundation.

Completion of these studies, including preparation of the larvae for study and the making of drawings, was facilitated by a grant from the Permanent Science Fund of the American Academy of Arts and Sciences.

Acknowledgment is made to the Grace H. Griswold Fund of the Entomology Department of Cornell University for assuming part of the expense of engraving the plates.

Subfamily Nyssoninae

Characters of the subfamily.—The following combination of characters will separate the larvae of the subfamily from those of other Sphecidae: integument smooth, or rarely very minutely and inconspicuously spinulose anteriorly and dorsally; body without setae except in some Bembicini; parietal bands absent or weak, never longer than the anterior tentorial arms; antennal orbits circular or nearly so; antennal papilla present, of variable length, bearing three sensory cones at its apex; head with a few scattered punctures, from some of which may arise small setae; labrum more or less flat, capable of being partially retracted beneath the clypeus; surface of labrum more or less punctate and with at least some very minute setae arising from some of the punctures; apical margin of labrum with usually at least some indication of a series of barrel-shaped sensilla; epipharynx spinulose or partly or wholly papillose; mandibles acuminate, approximately twice as long as broad at the base, the apex acute and the inner margin with from one to three teeth; base of the mandibles, laterally, with a few very small setae; maxillary palpi typically subequal in length to or slightly longer than the galeae, actually varying from very slightly shorter to nearly twice as long; spinneret consisting of paired openings, each at the end of a conical protuberance which does not greatly exceed in length the labial palpus.

Limits of the subfamily.—As characterized above, the larvae of the Nyssoninae form a clearly defined and closely knit group. However, it is necessary to exclude from the subfamily two groups which have occasionally been placed there. The tribe Mellinini, with the single genus *Mellinus,* has been placed in the Nyssoninae by various authors and was so placed in the Synoptic Catalog. We have seen no larvae of *Mellinus,* but the larva of *Mellinus arvensis* has been described by Maneval (1939, Ann. Soc. Ent. France, 108: 64-66). The inclusion of this larva in the Nyssoninae would do violence to so many of the characters of the subfamily as to make any accurate definition of the group impossible. We have therefore omitted *Mellinus* from the Nyssoninae and will consider it in a later paper of this series. Per-

haps in the meantime we will be able to obtain specimens for study so that we can confirm and enlarge upon Maneval's description.

Pate (1938, Trans. Amer. Ent. Soc., 64: 119) placed the Ampulicini in the Nyssoninae, stating that they seem to be an extremely sidewise specialized group related to the Alyssonini. On the basis of the few larvae of *Ampulex* which we have examined and Maneval's description of the larva of *Dolichurus corniculus* (1939, op. cit., p. 57), we are inclined to believe that these insects are not related to the Nyssoninae. Probably it is best to accord the Ampulicidae the status of a family, as has been done in the Synoptic Catalog. Certainly any resemblance the adults may have to the Alyssonini is contradicted completely by the larvae, which are about as different as it is possible for any two wasp larvae to be.

Classification on the basis of larval characters.—On the whole the larvae confirm the validity of the usual classification based on adult characters. The Alyssonini and the Nyssonini are immediately separable from the remainder of the complex on the basis of the peculiar dark-tipped elevations on the front of the head and the minute setae and poorly defined sensilla on the labrum, just as these two tribes are separable from the remainder of the subfamily on the basis of adult wing venation. Both lines of evidence suggest sidewise specialization from the more generalized Gorytini, with the Nyssonini standing closer to the Gorytini than the Alyssonini. The larva of *Alysson* is most remarkable in appearance, with six prominent nipple-like elevations on the front of the head and a very long antennal papilla;[2] all in all it is among the most specialized of sphecid larvae.

[2] Michener (1953, Kansas Univ. Sci. Bull., 35: 997) considers a long antennal papilla as primitive in the bees, and the absence of a papilla as specialized. However, those groups of bees usually regarded as most highly evolved (Megachilidae and Apidae) have the antennal papilla best developed. We are convinced that, within the Aculeata as a whole, the absence of an antennal papilla is primitive; the papilla is absent in the Scoliidae, Formicidae, Vespidae, Ampulicidae, and certain groups of Sphecidae which are considered primitive on most characters (Sphecinae, Larrinae). Within the Nyssoninae, the longest antennal papilla occurs in *Microbembex*, a genus which seems highly evolved both on the basis of ethology and of adult structure. Apparently the papilla has been acquired independently by several different stocks of Aculeata.

The remainder of the Nyssoninae form a closely knit group, and Pate's suggestion (1938, op. cit., p. 120) that they form a phyletic series beginning with the Gorytini and leading by way of the Stizini to the Bembicini seems entirely reasonable. The larvae of *Gorytes, Psammaecius,* and *Sphecius* are very similar and without any notable specializations, but the unusual mandibles of *Ochleroptera* suggest that that genus is sidewise-specialized. *Bembecinus,* in the Stizini, agrees with the Gorytini in most characters, but differs in having the mandibles distinctly tridentate and the epipharynx papillose rather than spinulose. *Bembecinus* is a somewhat specialized stizine on the basis of adult structure and of ethology, and could hardly be considered ancestral to the Bembicini on any grounds. Unfortunately the larva of the apparently more generalized genus *Stizus* is unknown.

The larvae of the Bembicini are very similar to those of the Gorytini, differing chiefly in the more spinose apical margin of the labrum and the (usually) strongly spinulose lacinial area of the maxilla. The Bembicini are characterized particularly by the development of body setae, which in several genera are fairly conspicuous and distributed over much of the body. However, such setae seem to be entirely absent in *Bicyrtes* and very nearly so in *Stictiella* and *Steniolia.* In most Bembicini that portion of the epipharynx between the two sensory areas is devoid of spinules, but in this respect *Stictiella* is more like the Gorytini. The mandibles of *Bicyrtes* and of *Microbembex* are unusual in that the tooth on the inner margin is broad and blunt. On the whole, *Stictiella* seems the most primitive of the Bembicini on the basis of larval characters, and *Microbembex* the most specialized. *Bicyrtes* stands apart somewhat from the other genera, and the remaining genera, *Steniolia, Stictia,* and *Bembix,* stand very close together. In fact, *Stictia* and *Bembix* are barely separable on larval characters except by size. However, the species of *Bembix* can be placed in several distinct groups on larval characters.

In the following summary of tribal and generic differences we have, as in Part I, indicated what species of each genus we have studied; the species known to us only from published descriptions are enclosed in brackets.

Table of Tribal and Generic Characters

A. Front with from one to six dark-tipped, nipple-like protuberances (figs. 1, 2, 8); labrum with only minute setae, its apical margin with the sensilla absent or ill-defined (figs. 4, 11).

B. Front with six nipple-like protuberances; antennae unusually long (figs. 1, 2, 6) ..... ALYSSONINI, *Alysson* (*melleus*)

BB. Front with one or three nipple-like protuberances; antennae very short (figs. 8, 9) .. NYSSONINI, *Nysson* (*daeckei,* [*dimidiatus*])

AA. Front without nipple-like protuberances (figs. 13, 30, 45); labrum with strong setae, its apical margin with a series of well-defined barrel-shaped sensilla (figs. 16, 26, 48).

B. Sides of the apical margin of the labrum with at most a few weak, barely protruding spines (figs. 16, 26, 33, 40); lacinial area papillose, sometimes in part spinulose (figs. 18, 27, 34, 41); antennae short, when appressed not reaching the rim of the orbit.

C. Mandibles with a single well-defined tooth on the inner margin in addition to the apical tooth (figs. 19, 28); epipharynx spinulose (figs. 16, 26, 33) .....GORYTINI

D. Mandible with a blunt, molar-like tooth, and the lower surface of the mandible with a patch of elongate knobs (fig. 28); epipharynx with the spinules very minute, mostly in transverse rows (fig. 26); head slightly wider than high (fig. 23) ..... *Ochleroptera* (*bipunctata*)

DD. Mandible with the tooth simple, and without such knobs (fig. 19); epipharynx with the spinules larger, not in rows (figs. 16, 33); head slightly higher than wide (figs. 13, 30).

E. Size large (full-grown larva over 30 mm.); parietal bands present (fig. 30); walls of the spiracular atria with rows of small spines (fig. 36).
Sphecius (*speciosus*)

EE. Size small (full-grown larva under 20 mm.); parietal bands absent (fig. 13); walls of the spiracular atria divided into irregular hexagons (fig. 15).

F. Labrum with the sensilla on the apical margin smaller and more crowded, at least 11 on each side of the median line (fig. 44).
Psammaecius (*nebulosus,* [*latifrons*])

FF. Labrum with the sensilla on the apical margin somewhat larger and less crowded, with from 3 to 12 on each side of the median line (fig. 16, 21).
Gorytes (*canaliculatus, asperatus,* [*planifrons*])

CC. Mandibles with two sharp teeth, each in a slightly different plane, on the inner margin in addition to the apical tooth

(fig. 37); epipharynx papillose (fig. 40); galeae much shorter than the maxillary palpi (fig. 41).

STIZINI, *Bembecinus* (*neglectus*, [*tridens*])

BB. Sides of the apical margin of the labrum roughly spinose (figs. 48, 61, 67); lacinial area roughly spinose or setose (figs. 52, 62) *or* the antennae long, when appressed reaching well beyond the rim of the orbit (fig. 83) ..... BEMBICINI

C. Lacinial area with flat papillae (fig. 81); antennae very long, when appressed reaching far beyond the rim of the orbit (fig. 83); mandibles with a broad molar-like tooth on the inner margin (fig. 80) ..... *Microbembex* (*monodonta*)

CC. Lacinial area with long, spine-like setae (fig. 87); antennae shorter, at most extending very slightly beyond the rim when appressed (figs. 77, 86).

D. Mandibles with a broad, molar-like tooth (figs. 49, 55, 58); epipharyngeal sensory areas connected by a pigmented band (figs. 48, 53, 56); antennae, when appressed, reaching the rim of the orbit (figs. 46, 54, 57).

Bicyrtes (*quadrifasciata, fodiens, ventralis*)

DD. Mandibles without a broad, molar-like tooth (figs. 65, 72); epipharyngeal sensory areas not connected by a pigmented band, or if so, the antennae are shorter and do not reach the rim of the orbit when appressed.

E. Body completely devoid of setae except for a few extremely small and scarcely noticeable ones on the thoracic dorsum; extreme sides of the epipharynx more or less spinulose and unpigmented (figs. 61, 63, 67).

F. Space between the two epipharyngeal sensory areas devoid of spinules (fig. 67); antennae not twice as long as thick (fig. 68).

Steniola (*elegans, nigripes*)

FF. Space between the two epipharyngeal sensory areas filled with spinules (figs. 61, 63); antennae at least twice as long as thick (figs. 60, 64).

Stictiella (*serrata, pulla*)

EE. Body with setae on the posterior annulets, pleural lobes, and venter of most segments (apparent at least under high magnification and good light) (fig. 73); extreme sides of the epipharynx pigmented and papillose (figs. 75, 90).

F. Full-grown larva over 30 mm. in length; integument minutely spinulose, at least anteriorly and dorsally (fig. 74); apical margin of labrum with about 18 sensilla on each side of the median line (fig. 75) ..... *Stictia* (*carolina*)

FF. Full-grown larva under 30 mm. in length; integument smooth or with inconspicuous flat granules. *Bembix* (*pruinosa, occidentalis, spinolae, comata, sayi, cinerea, belfragei, troglodytes, texana,* [*integra, olivacea, oculata*]) [3]

Tribe Alyssonini

Alysson melleus Say (Plate II, figs. 1-7)

Body.—Length 9 mm.; maximum width (abdominal segment 3) 3 mm. (fig. 3). Body pale, without sclerotized parts, without setae; spiracles small, unpigmented. Pleural lobes prominent, rounded, partially obliterating the intersegmental lines between them; each segment slightly convex ventrally, more so dorsally, the dorsum of each segment weakly divided into two annulets. First two thoracic tergites with weak, unsclerotized transverse raised folds. Last abdominal segment bluntly rounded, the supra-anal lobe more prominent than the subanal. Integument smooth.

Head.—Higher than wide, measuring .67 mm. wide and .7 mm. high (figs. 1, 2). Pale, the mandibles light brown at the base, becoming darker apically. Front of head with six nipple-like protuberances, each capped by a small, light brown, sclerotized prominence; two pairs of these are lateral, one above and one below each antenna; the other two are median, one in the middle of the front and one in the middle of the clypeus. Antennal orbit 60 μ in diameter, the center somewhat raised and giving rise to an elongate papilla, about 65 μ long, which bears three slender sensilla at its tip (fig. 6). Coronal suture weakly defined; parietal bands absent. There are a few small, setigerous punctures on the lower sides of the head capsule and on the clypeus.

Mouthparts.—Labrum .28 mm. wide and .12 mm. high, or 2.3 times as wide as high; apical margin weakly emarginate (fig. 4). Upper surface of labrum with a few punctures from which arise minute setae; toward the apical margin the surface becomes papillose, the margin itself papillose but without well-defined sensory cones. Epipharynx covered with short, stout spinules, which are more dense laterally than medially; sensory pores about six on each side, intermingled with the spinules and situated some distance from the median line. Mandibles .33 mm. long and .16 mm. wide at the base; apex acute and inner margin with a single angular tooth some distance from the apex; base of each mandible laterally with a single small seta. Maxilla (fig. 5) with a few setae laterally; lacinial area papillose, with a few small spinules interspersed with the papillae; palpi 55 μ long, 23 μ wide at the base, terminating in four sensilla; galeae about 30 μ long,

[3] A table for the separation of some of the American species of *Bembix* is presented under that genus in the text. The presence of body setae has not been noted for the three European species which have been studied, and one of these species (*integra*) appears to agree in characters of the epipharynx much more closely with *Stictiella* than with *Bembix*.

10 μ wide at the base, terminating in two protruding sensilla. Labial palpi 40 μ long and 20 μ wide at the base; spinnerets each measuring about 80 μ long on the sides, 40 μ long measured from their median point of union (fig. 7). Hypopharynx prominent, strongly papillose.

Material.—Described from three specimens collected by the writers at Blackjack Creek, Pottawatomie Co., Kansas, in June 1952.

Tribe Nyssonini

Nysson daeckei Viereck [4] (Plate II, figs. 8-10; plate III, figs. 11, 12)

Body.—Length 7.5 mm.; maximum width 3 mm. (fig. 10). Pale, without setae, integument smooth. Spiracles lightly pigmented, the prothoracic spiracle slightly larger than the others. Pleural lobes prominent, somewhat conical, the tips of the lobes (especially posteriorly) weakly sclerotized. Dorsum of prothorax with a pair of nipple-like, lightly sclerotized callosities; mesothorax with a similar pair of much weaker callosities. All the tergites behind the mesothorax divided into two annulets, the anterior slightly shorter than the posterior, the posterior continuing down to the pleural lobes on each side; each posterior annulet bears a rather prominent transverse elevated band, weakly sclerotized, interrupted on the mid-dorsal line. Last abdominal segment bluntly rounded, the supra-anal and subanal lobes about equally prominent.

Head.—In anterior view subcircular; width about .9 mm.; height about .8 mm. (fig. 8). Pale, the mandibles brown, darkest apically; palpi and galeae light brown. Front with a median nipple-like protuberance, capped with a brown, sclerotized tip, situated directly between the antennae; also with a pair of similar but less conspicuous prominences just above the antennae. Coronal suture weak but rather long; parietal bands absent. Antennal orbits 50 μ in diameter; antennal papilla 10 μ in length, scarcely longer than wide, terminating in three small sensilla (fig. 9). Front and clypeus with a few small, scattered punctures.

Mouthparts.—Labrum .32 mm. wide and .13 mm. high, or about 2.5 times as wide as high; apical margin weakly emarginate (fig. 11). Upper surface of labrum with a few setigerous punctures laterally, but the setae extremely small; apical margin apparently with five very small, poorly defined sensilla on each side of the median line. Epipharynx spinulose; sensory areas lightly pigmented, each with three pores. Mandibles .4 mm. long and .25 mm. wide at the base; inner margin with an angulate tooth in addition to

[4] The larva described here was found in a nest of *Gorytes canaliculatus* at Ithaca, N. Y. It was identified as a *Nysson* by comparison with the published description of the European *N. dimidiatus*. In the area where this specimen was collected, *N. daeckei* was seen entering the nests of *Gorytes canaliculatus* on two different occasions, and it therefore seems probable, though by no means certain, that the larva described here is that of *daeckei*.

the apical tooth; base of each mandible laterally with three minute setae. Maxillae (fig. 12) with a few lateral setae; lacinial area densely papillose; palpi 70 μ long and 30 μ wide at the base, with only two or three small sensilla at the tip; galeae 55 μ long and 20 μ wide at the base, with two sensilla at the tip. Prementum with a few small setae; labial palpi about 50 μ long; spinnerets not quite as long as the palpi.

Material.—A single specimen found in a nest of *Gorytes canaliculatus* at Six Mile Creek, Ithaca, N. Y., June 15, 1954 (C. S. Lin).

Nysson dimidiatus Latreille

The larva of this European species has been described by Maneval (1939, Ann. Soc. Ent. France, 108: 66-70). The larva resembles the one just described in its gross appearance; the pleural lobes and dorsal annulets are very prominent; the thoracic dorsum bears two pairs of slightly sclerotized prominences. The front bears a single nipple-like, sclerotized prominence directly between the antennae; the antennae are barely longer than thick; the mandibles have a rather weak tooth on the inner margin in addition to the apical tooth; the galeae are as long as the maxillary palpi but much more slender. Maneval's description is brief, but sufficient to confirm the generic value of such characters as the short antennae and the mid-frontal prominence.

Tribe Gorytini

Gorytes canaliculatus Packard (Plate III, figs. 13-20)

Body.—Length 10.5 mm.; maximum width 3 mm. (fig. 17). Body pale and without setae; integument smooth. Pleural lobes prominent, conical, the slopes somewhat wrinkled and the tips somewhat nipple-like and apparently very lightly sclerotized. Dorsally each segment is transversely wrinkled and shows a feeble division into an anterior and a slightly longer posterior annulet; each abdominal segment (except the last two) bears a pair of dorso-lateral transverse callosities. Last abdominal segment blunt, the supra-anal lobe slightly more prominent than the subanal. Spiracles light brown, the prothoracic spiracles very slightly larger than the others. Spiracular atria (fig. 15) lined with hexagonal cellules.

Head.—Width .65 mm.; height .68 mm. (fig. 13). Pale; mandibles brown, darkest at the tips; anterior tentorial arms and hypostomal thickenings brown; galeae, palpi, and basal portions of stipites and prementum pale brownish. Front with two pairs of vertical depressions, one just mesad of the antennal orbits, the other mesad of these and close to the mid-line. Coronal suture short; parietal bands absent. Antennal orbits circular, 50 μ in diameter; antennae knob-like, about 15 μ long and 10 μ thick (fig. 14). Front of head with a few small, scattered punctures, a few grouped together just above the epicondyle and a row of six or seven on each side of the clypeus.

Mouthparts.—Labrum .29 mm. wide; apical margin with a V-shaped median emargination (fig. 16). Upper surface of labrum with a few punctures, from some of which arise setae; apical margin with about ten barrel-shaped sensilla on each side of the median line; sides of the apical margin weakly spinose. Epipharynx wholly covered with spinules, which are larger toward the apical margin; sensory areas consisting of four widely separated pores on each side. Mandibles .32 mm. long and .16 mm. wide at the base; inner margin with a low, rounded tooth in addition to the apical tooth; base of each mandible laterally with three or four minute setae (fig. 19). Maxillae (fig. 18) with a few setae laterally; lacinial area spinulose, the spinules becoming more rounded, papilla-like, apically; palpi large, 65 μ long, ending in several sensory cones; galeae 50 μ long, ending in two sensory cones. Prementum with a few apical setae, the oral surface papillose; labial palpi 55 μ long; spinnerets about 50 μ long, sharply pointed.

Material.—Three specimens, two from Ithaca, N. Y., June 20, 1955 (H. E. Evans), and one from Ithaca, June 15, 1954 (C. S. Lin).

Gorytes asperatus Fox (Plate IV, figs. 21, 22)

The single available specimen of this species is rather small and possibly not in the last instar; this may account for some of the apparent differences from *canaliculatus*.

Body.—Length 8 mm.; maximum width about 2 mm. Body pale and without setae; integument smooth; pleural lobes poorly developed; dorsum of each segment prominently convex, with no evidence of division into annulets; last abdominal segment conical, the anus a transverse slit at its apex.

Head.—Width .75 mm.; height .8 mm. Coronal suture unusually long; parietal bands apparently represented by short, weak impressions. Antennal orbits situated unusually close to the base of the mandibles; orbits 65 μ in diameter, the antennae 40 μ in length (fig. 22). Anterior tentorial arms not deflected upward as in most other sphecids. There are a few very small setae on the lower sides of the head capsule.

Mouthparts.—Labrum .35 mm. wide, its apical margin with a broad emargination (fig. 21). Surface of labrum with a few setigerous punctures, the apical margin strongly papillose and bearing three very large sensilla on each lateral lobe; epipharynx not clearly visible on the available specimen. Mandibles .42 mm. long and .18 mm. wide at the base, with a sharp apical tooth and a second sharp tooth on the inner margin some distance back from the apex. Maxillae with the palpi about 60 μ long, the much more slender galeae about 45 μ long; lacinial area entirely papillose. Labium with the palpi very short, only about 30 μ in length; spinnerets not strongly protuberant.

Material.—Described from a single specimen collected in Pottawatomie Co., Kansas, on June 25, 1952 (H. E. Evans).

Gorytes planifrons (Wesmael)

Maneval has described the diapausing larva of this European species (1939, Ann. Soc. Ent. France, 108: 57-61). The body length is given as 8 mm. Each segment bears a pair of dorsal convexities, separated on the mid-dorsal line; the pleural lobes are strong, transverse, each lobe ending in a smooth, oval plate. The head is subcircular in anterior view; the antennae are scarcely longer than broad. The labrum is broadly emarginate apically, and each lateral lobe bears several well-separated sensory cones. The mandibles bear a weak tooth on the inner margin in addition to the apical tooth. The maxillary palpi are stout, about as long as the much more slender galeae. The spinnerets are protuberant to about the length of the labial palpi.

On the basis of Maneval's description, *planifrons* would appear to agree rather closely with the Nearctic *canaliculatus*. There is essential agreement in general body form and in the nature of the pleural lobes, the antennae, the mandibles, and the maxillae. It is possible that higher magnification of Maneval's specimens might have revealed a close agreement of structures of the labrum with *canaliculatus*.

Psammaecius nebulosus (Packard) (Plate VI, figs. 43, 44)

Body.—Length 8 mm.; maximum width 2.8 mm. The single available larva, removed from a cocoon, is sketched in figure 43. The pleural lobes are very prominent, almost pointed; the middle body segments are strongly produced dorsally on each side of the median line, the latter slightly depressed. Venter rather flat, the middle body segments with small transverse elevations. Supra-anal lobe slightly more prominent than the subanal.

Head.—Width .68 mm.; height .7 mm. Features virtually identical with *Gorytes canaliculatus*. Antennal orbits circular, 50 μ in diameter; antennae about 15 μ long and 10 μ thick.

Mouthparts.—Labrum .33 mm. wide; apical margin with a distinct emargination and with about 11 sensilla on each side (fig. 44). Epipharynx wholly covered with small spinules; sensory areas consisting of about seven pores on each side. Mandibles and maxillae much as in *Gorytes canaliculatus;* lacinial area, as in that species, with the spinules grading into papillae at the apex; palpi stout, 70 μ in length; galeae much smaller, about 45 μ in length. Labium much as illustrated for *Gorytes,* the spinnerets prominent, about 60 μ long, strongly divergent.

Material.—A single specimen taken from a cocoon collected at Ithaca, N. Y., on July 2, 1954 (C. S. Lin).

Psammaecius latifrons (Spinola)

The larva of this European species has been described by Maneval (1937, Rev. Franc. Ent., 4: 163-165). The body is described as being cylindrical, little attenuated at the extremities, the intersegmental lines deeply impressed, the pleural lobes moderately strong on the abdomen. The labrum

is convex, with an apical emargination and a longitudinal impression, the margin denticulate by virtue of small sclerotized lamellae situated in series on the margin. The mandibles are subacute at the apex and have a single weak tooth on the inner margin. The maxillary palpi are very short and stout, the galeae slender, digitiform, longer than the palpi. The spinnerets are long, slender, and protuberant. The antennae are very short.

There are a number of points of agreement with *nebulosus*, for example, the antennae, mandibles, and spinnerets are similar. However, one is struck by the differences in the maxillary palpi and the labrum. It is probable that the series of lamellae on the margin of the labrum actually represents a row of small sensilla.

Sphecius speciosus (Drury) (Plate V, figs. 30-36)

Body.—Length 37 mm.; maximum width 11 mm. (fig. 32). Integument smooth, body without setae. Pleural lobes large, round. Ventral surface much less convex than dorsal; each segment dorsally crossed by a transverse furrow which divides it into two annulets; each posterior annulet laterally more or less confluent with the pleural lobes, and dorso-laterally with a transverse convexity on each side, these convexities more prominent on the thoracic and first two abdominal segments. Last abdominal segment rounded. Spiracles brown, all about the same size. Spiracular atria with numerous rows of small spines (fig. 36).

Head.—Width 1.32 mm.; height 1.5 mm. (fig. 30). Pale, the mandibles nearly black, the anterior tentorial arms and pleurostomal and hypostomal thickenings dark brown; clypeus with a pair of brownish blotches; basal portion and inner margin of maxilla brown; prementum with lateral brown bands which nearly meet ventrally. Coronal suture strong, apparently giving rise to weak lateral arms in a shallow depression in the center of the front; below this and between the antennae is a pair of small depressions. Parietal bands visible as short, weak lines above the antennae. Antennal orbits about 110 μ in diameter, the antennae 30 μ in length, terminating in three small sensilla (fig. 31). Epistomal suture not evident; labroclypeal suture strong, straight. Head with weak, scattered punctures.

Mouthparts.—Labrum .8 mm. wide, the apical margin with a broad emargination (fig. 33). Surface of labrum with numerous punctures, more crowded toward the margin, some of them giving rise to setae; anterior margin weakly spinose and provided with 10 barrel-shaped sensilla on each side of the median line, the lateral ones set back from the margipn. Epipharynx spinulose; sensory areas consisting of five pores with pigmented rims on each side, and some weaker pores basad of these. Mandibles .92 mm. long and .4 mm. wide at the base; inner margin with a single, rather blunt tooth in addition to the apical tooth; sides with a few weak setae in a group near the base. Hypopharynx densely spinulose. Lacinial area papillose apically, spinulose below the apex; palpi 120 μ in length; galeae

about as long as the palpi, but more slender and pointed. Labium with the spinnerets rather long (150 μ), pointed at the apex; palpi about 120 μ long; upper surface of prementum papillose; prementum with a triangular median prolongation.

Material.—Two specimens collected at Pittsford, N. Y., July 30, 1955 (H. E. Evans & K. W. Cooper); 5 specimens from cocoons, without locality data [U. S. Nat. Mus.].

Ochleroptera bipunctata (Say) (Plate IV, figs. 23-29)

Body.—Length 4 mm.; maximum width 1.7 mm. (fig. 25). Body pale and without setae, the integument smooth. Spiracles small and virtually unpigmented. Pleural lobes prominent, rounded. Each segment divided dorsally into a small anterior and a larger and more convex posterior annulet. Mesothorax with a pair of lightly pigmented callosities on the sides of the dorsum. Supra-anal lobe prominent, rounded, extending well beyond the subanal.

Head.—Width .6 mm.; height .52, thus slightly wider than high (fig. 23). Pale, pigmentation about as in *Gorytes*. Coronal suture short; parietal bands and epistomal suture very faintly indicated. Antennal orbits circular, 30 μ in diameter; antennae minute, about 15 μ long and 10 μ wide, bearing three sensilla at the tip (fig. 24). There are a few minute setigerous punctures on the front and clypeus.

Mouthparts.—Labrum .24 mm. wide, the apex only very weakly emarginate (fig. 26). Upper surface of labrum with a few punctures, from some of which arise setae; margin with a series of small sensilla, about seven on each side of the median line. Epipharynx with the spinules minute, mostly arranged in transverse rows; sensory areas close to the margin, each with five pores. Mandibles (fig. 28) measuring .26 mm. long and .13 mm. wide at the base; apex acute; inner margin with a large, blunt, molar tooth; base with a single seta on the upper surface; lower surface of mandible with a patch of about 30 elongate knobs, directed outward, located at the base of the molar tooth. Maxillary stipes with a few setae laterally near the apex; lacinial area somewhat papillose; palpus about 60 μ long and 28 μ wide at the base; galea 35 μ long and 12 μ wide at the base (fig. 27). Prementum narrow and elongate, the spinnerets prominently protruding, about 60 μ long; labial palpi about 35 μ long (fig. 29).

Material.—Described from a single specimen collected by C. S. Lin at Ithaca, N. Y., on September 30, 1954.

Tribe Stizini

Bembecinus neglectus (Cresson) (Plate VI, figs. 37-42)

Body.—Length 18.5 mm.; maximum width 5.2 mm. (fig. 39). Pale and without setae; integument smooth except apparently for the dorsal part of

the prothorax, where it is weakly spinulose. Pleural lobes well developed, rounded, partially obliterating the intersegmental lines. Dorsum of each segment rather indistinctly divided into two annulets. Posterior end blunt, the supra-anal and subanal lobes about equally developed. Spiracles lightly pigmented, the prothoracic spiracles very slightly larger than the others; spiracular atria with the walls divided into irregular hexagons, about as illustrated for *Gorytes canaliculatus*.

Head.—Width .9 mm.; height about the same (fig. 37). Pale, the mandibles light brown, their apices rufous; pleurostomal thickenings brown; antennae, galeae, and palpi light brown. Top and sides of the head capsule roughened by small convexities. Coronal suture fairly long, unpigmented; parietal bands barely evident. Front with a vertical impression just mesad of each antennal orbit, and with weak impressions at the end of the coronal suture, in the center of the front, and at the epistomal suture. Antennal orbits large, circular, 90 μ in diameter; antennae about 20 μ long and nearly as broad (fig. 38). There are numerous setigerous punctures scattered widely over the head capsule and clypeus; some of the setae arising from these are fairly conspicuous, especially on the lower sides of the head.

Mouthparts.—Labrum .4 mm. wide, weakly emarginate apically (fig. 40). Upper surface of labrum with scattered punctures, from some of which arise some rather large setae; apical margin closely packed with sensilla, of which there are about ten on each side of the median line. Epipharynx densely papillose, some of the lateral papillae rather acute; sensory areas each consisting of two pores with pigmented rims and four weaker pores basad of these. Mandibles .5 mm. long and .24 mm. wide at the base; apex acute and inner margin with two teeth, each in a slightly different plane; each mandible with three small setae near the base laterally. Maxillary stipes with a few lateral setae; lacinial area strongly papillose, some of the papillae slightly pointed; maxillary palpi 80 μ long, terminating in four small sensilla; galeae 55 μ long, terminating in two sensilla (fig. 41). Prementum with several setae ventrally; spinnerets rather broad and not strongly protuberant, only about 50 μ long (fig. 42).

Material.—Described from nine specimens collected by the writers at Little Gobi Desert, Pottawatomie Co., Kansas, in June and July, 1953. These specimens were collected in connection with ethological studies which have been published elsewhere (Evans, 1955, Behaviour, 7: 287-303).

Bembecinus tridens (Fabricius)

Grandi (1930, Boll. Lab. Ent. Bologna, 3: 312-316) has described the larva of this European species, which appears to be strikingly similar to *neglectus*. The head capsule bears numerous setigerous punctures; the antennae are short, the orbits rather large. The labrum bears numerous fairly long setae and its apical margin is weakly notched medially and bears

a series of small sensilla. The epipharynx is papillose over its entire surface; several sensory pores are situated in a pigmented area close to the margin, and several others scattered across the epipharynx back from the margin. The mandibles are exactly as described for *neglectus,* although with apparently only two setae near the base. The galeae are considerably shorter than the maxillary palpi and the lacinial area is entirely papillose. The spinnerets are protuberant to about the length of the labial palpi. The only noteworthy differences from *neglectus* appear to lie in the epipharynx.

Tribe Bembicini

Bicyrtes quadrifasciata (Say) (Plate VII, figs. 45-52)

Body.—Length 22 mm.; maximum width 6.5 mm. (fig. 47). Integument essentially smooth, although with some indication of flat granules anteriorly and dorsally; body wholly without setae. Pleural lobes strong, rounded; dorsum of each segment weakly divided into two annulets. Posterior end blunt, the supra-anal lobe more probinent than the subanal. Spiracles (fig. 50) with the walls of the atria ringed with ridges bearing short, dense spines; subatria swollen.

Head.—Wider than high; width 1.42 mm.; height 1.3 mm. (fig. 45). Pale, the mandibles reddish-brown; anterior tentorial arms and pleurostomal and hypostomal thickenings brown; antennae, galeae, and palpi light brown. Parietal bands represented by short, weak pigmented lines; epistomal suture represented by only a faint impression; coronal suture strong. Antennal orbits 120 μ in diameter; antennae 80 μ in length and 30 μ in width, when appressed extending beyond the rim of the orbit (fig. 46). Front and clypeus with scattered punctures, those on the lower sides of the head capsule bearing short setae.

Mouthparts.—Labrum .57 mm. wide, about 2.5 times as wide as high, its apical margin with only a weak emargination; the labrum is rather characteristically shaped, being broadest at the base, the sides tapering gradually to a more narrow apex (fig. 48). Surface of labrum with numerous punctures, from some of which arise rather large setae; apical margin with 11 barrel-shaped sensilla on each side of the median line; margin bristly, especially on the sides. Epipharynx spinulose; each sensory area with five to eight pores, the two sensory areas connected by a broad, darkly pigmented band. Mandibles .66 mm. long and .33 mm. wide at the base; inner margin with a broad, blunt, molar-like tooth in addition to the apical tooth; lateral basal portion swollen, the swelling bearing four or five setae (fig. 49). Hypopharynx strongly spinulose. Maxillae with numerous strong setae laterally; lacinial area strongly spinulose; palpi about 100 μ long, terminating in five small sensory cones; galeae about 90 μ long, strongly tapering apically, the tip with two small sensilla (fig. 52). Prementum with numerous strong setae below, upper surface papillose medially and spinulose laterally; palpi 70 μ long, the apex blunt and bearing five sensilla; spinnerets about 90 μ long (fig. 51).

Material.—Described from eight specimens collected by the authors as follows: 3 from Ithaca, N. Y., July and Aug. 1953-55; 3 from Pottawatomie Co., Kansas, July 3-24, 1952-53; 1 from Clay Co., Kansas, Aug. 11, 1952; 1 from Scott Co., Kansas, Aug. 26, 1952.

Bicyrtes fodiens (Handlirsch) (Plate VIII, figs. 53-55)

Body.—Length 16 mm.; maximum width 4.5 mm. Form very similar to *quadrifasciata;* pleural lobes especially prominent on the thorax; supra-anal and subanal lobes about equally developed.

Head.—Width 1.32 mm.; height 1.25 mm. Features essentially as described for *quadrifasciata.* Antennal orbits 110 μ in diameter, the antennae 52 μ long and 21 μ wide, barely extending beyond the rim of the orbit when appressed (fig. 54).

Mouthparts.—Labrum .54 mm. wide, the apical margin somewhat more deeply emarginate than in *quadrifasciata* (fig. 53); margin with at least 12 barrel-shaped sensilla on each side of the median line (these are so crowded medially as to be difficult to count). Epipharynx strongly spinulose, the spinules strongest just in front of the transverse pigmented band; sensory areas each consisting of seven pores on each side of this band and one more just above it. Mandibles (fig. 55) about .6 mm. long and .3 mm. wide at the base, similar to *quadrifasciata* but with less of a swelling toward the base laterally and with some small papillae at the base of the molar tooth. Maxillae with the spinules on the lacinial area not quite as strong as in *quadrifasciata;* palpi 90 μ long; galeae 70 μ long. Labium as in *quadrifasciata,* the palpi 70 μ long and the spinnerets about the same length.

Material.—Five specimens collected by the writers at Blackjack Creek, Pottawatomie Co., Kansas, July 2-7, 1952-53.

Bicyrtes ventralis (Say) (Plate VIII, figs. 56-58)

Body.—Length 16.5 mm.; maximum width 5.2 mm. Very similar to *quadrifasciata;* pleural lobes very prominent on the thorax and first four abdominal segments; each segment with a small transverse raised fold dorsally just behind the transverse impression.

Head.—Width 1.24 mm.; height 1.1 mm. Features as in the preceding two species. Antennal orbits 95 μ in diameter, the antennae 55 μ long and 24 μ wide, or about 2.3 times as long as wide (fig. 57).

Mouthparts.—Labrum .52 mm. wide (fig. 56); details as in *fodiens,* except that only ten sensilla can be counted on each side of the mid-line; on the epipharynx there appear to be five pores on each side within the pigmented band, with two or three more basad of these. Mandibles (fig. 58) as in *quadrifasciata* except that there are about nine setae on each lateral swelling and there are numerous small papillae at the base of the molar tooth; mandibles .6 mm. long and .3 mm. wide at the base. Maxillae as in *fodiens.*

including measurements of the appendages. Labium with the palpi about 65 μ long, the spinnerets about 80 μ long.

Material.—Four specimens collected by the authors, two at Ithaca, N. Y., Aug. 23, 1954, and July 26, 1955, and two in Pottawatomie Co., Kansas, June 30, 1952, and June 26, 1953.

Stictiella serrata (Handlirsch) (Plate VIII, figs. 59-62)

Body.—Length 18 mm.; maximum width 5 mm. General form as in *Bicyrtes;* each segment with a weak, rounded pleural lobe, the intersegmental lines distinct between the lobes; each segment weakly divided dorsally into two subequal annulets. Prothoracic spiracles 130 μ in diameter, all the other spiracles about 110 μ in diameter. Body setae absent except for a few very minute ones on parts of the thoracic dorsum.

Head.—Slightly wider than high; width 1.13 mm.; height 1.07 mm. (fig. 59). Straw-colored; mandibles brown, their apices dark ferruginous; anterior tentorial arms, pleurostomal and hypostomal thickenings brownish; tips of antennae dark brown; a faint blotch on the inner margins of the antennal orbits; palpi, galeae, and base of the prementum light brown. Coronal suture strong; parietal bands only very faintly indicated. Just mesad of each antennal orbit there is a vertical depression; in the middle of the front are two more depressions which converge slightly above. Area of the epistomal suture depressed, the suture not clearly defined. Antennal orbits about 100 μ in diameter; antennae situated on a slight conical elevation, about 50 μ long and 20 μ wide, when appressed barely reaching the rim of the orbit (fig. 60). Head capsule with numerous setigerous punctures, absent only from the median area; setae on the lower sides of the head, just above the mandibles, and on the sides of the clypeus, somewhat larger than the others.

Mouthparts.—Labrum .48 mm. wide, the apex with a median emargination (fig. 61); surface with numerous large punctures and setae; anterior margin thickly beset with long bristles, and with about 12 closely packed barrel-shaped sensilla on each side of the median line. Epipharynx with dense spinules which are quite long toward the apical margin; sensory areas consisting of six pores on each side which are set in a small pigmented area; space between the two sensory areas filled with small spinules. Mandibles .58 mm. long, .28 mm. wide at the base; inner margin with two distinct, acute teeth in addition to the apical tooth; side of each mandible with about ten setae near the base. Hypopharynx with dense and rather long spinules. Sides of maxillae with numerous setae; lacinial area with dense and rather long spinules; palpi 100 μ long and about 40 μ wide at the base; galeae 70 μ long and 30 μ wide at the base (fig. 62). Prementum with several setae on the ventral side, and with a few spinules on the oral surface toward the base; palpi 70 μ long, the spinnerets about the same length; there appears to be a small lobe at the base of each spinneret.

Material.—Described from a single larva reared from an egg collected by H. E. and M. A. Evans at the Archbold Biological Station, Lake Placid, Florida, April 28, 1955.

Stictiella pulla (Handlirsch) (Plate IX, figs. 63-65)

Body.—Length 13 mm.; maximum width 2.5 mm. Pleural lobes prominent, especially on the thorax. Prothoracic spiracle larger than the others. A few weak setae are present on the thoracic dorsum.

Head.—Width 1.25 mm.; height about the same. Features as in *serrata.* Antennal orbits subcircular, 90 μ in diameter; antennae shorter than in *serrata,* about 45 μ long and 20 μ wide, when appressed not quite reaching the rim of the orbit (fig. 64).

Mouthparts.—Labrum 50 mm. wide, the apex weakly emarginate medially (fig. 63); surface with numerous punctures, most of which bear large setae; apex with numerous small sensilla, about 14 on each side of the mid-line, most of them recessed from the margin. Epipharynx densely spinulose; sensory areas darkly pigmented, each containing about 10 pores, and connected to the base of the epipharynx by a narrow pigmented band. Mandibles (fig. 65) shaped as in *serrata,* but with an additional small tooth between the apex and the subapical tooth, making them appear quadridentate; base swollen on the sides, the swelling bearing about 10 setae. Maxillary palpi and galeae each about 90 μ in length, the galeae more slender and tapering than the palpi (much as figured for *Steniolia elegans,* fig. 69). Labial palpi 65 μ in length, the prementum with a spinulose area on the oral surface.

Material.—Described from three specimens collected 9 miles south of Shoshone, Jerome Co., Idaho (J. E. Gillaspy).

Steniolia elegans Parker (Plate IX, figs. 66-71)

Body.—Length 20 mm.; maximum width 6 mm. Form similar to *Bicyrtes;* pleural lobes rather weak, but the dorsal annulets very distinct. Body virtually without setae, although a few very minute ones are visible on the thoracic dorsum; integument essentially smooth, but anteriorly and dorsally very weakly granulate. Anterior spiracles very slightly larger than the others; spiracular atria (fig. 71) lined with anastomosing ridges which bear minute spinules.

Head.—Width 1.6 mm.; height 1.5 mm. (fig. 66). Pale, with a brownish blotch below the antennal orbits; anterior tentorial arms brown; mandibles brown, darker apically; galeae, palpi, and base of the prementum light brown. Parietal bands short and weak. Antennal orbits circular, 100 μ in diameter; antennae short, 35 μ long and about 20 μ wide, when appressed not nearly reaching the rim of the orbit (fig. 68). Head with scattered punctures, some of which bear very short setae.

Mouthparts.—Labrum .63 mm. wide, the apex barely emarginate (fig. 67); margin with about 15 barrel-shaped sensilla on each side; surface with numerous large setae. Epipharynx densely spinulose except in a band connecting the sensory areas, which is bare; each sensory area with about ten large pores; sides of the epipharynx with a longitudinal pigmented band which does not connect with the sensory area. Mandibles .75 mm. long and .43 mm. wide at the base; sides swollen and pale toward the base, with about ten setae in a group; inner margin with two strong and a weak third tooth, thus appearing, with the apical tooth, weakly quadridentate, much as in *Stictiella pulla*. Hypopharynx and lacinial area strongly spinulose; galeae 100 μ long; maxillary palpi about the same length, but much stouter (fig. 69). Oral surface of prementum strongly papillose, the median area also spinulose; labial palpi 80 μ long, the spinnerets protruding to about the same extent (fig. 70).

Material.—Two specimens from 4 miles E., 4 miles N. of Owinza, Lincoln Co., Idaho (J. E. Gillaspy).

Steniolia nigripes Parker

Body.—Length 24 mm.; maximum width 6 mm. Anterior portion of each posterior annulet with a transverse welt-like elevation. Thoracic dorsum with a few very minute setae, and the integument in this area very minutely and obscurely granulose, otherwise smooth. Spiracles as in *elegans*.

Head.—Width 1.8 mm.; height 1.6 mm. Parietal bands slightly longer than in *elegans*, somewhat angulate near the top; head with somewhat more punctures and setae than in *elegans*. Antennal orbits slightly eccentric, slightly prolonged mesad and ventrad, about 120 μ in maximum diameter; antennae about 45 μ long and 25 μ in maximum thickness.

Mouthparts.—Labrum .7 mm. wide, almost exactly as figured for *elegans* except for a more conspicuous group of lateral pores situated in a pigmented area. Epipharynx as in *elegans*, the lateral pigmented bands very conspicuous and exactly as in that species. Mandibles quadridentate, much as figured for *Stictiella pulla* (fig. 65); base of the mandibles laterally with a group of about 12 small setae. Maxillary palpi about 120 μ long, the galeae more slender and tapering, about 100 μ long. Oral surface of prementum spinulose; spinnerets protruding to about the length of the labial palpi.

Material.—Described from 10 specimens collected at Borrego, San Diego Co., Calif., April 26, 1955 (P. D. Hurd and P. H. Timberlake) [Calif. Insect Survey].

Stictia carolina (Fabricius) (Plate X, figs. 72-78)

Body.—Length 31 mm.; maximum width 9 mm. (the largest specimen available measures 40 mm. in length, 14 mm. in maximum width). Body

form (fig. 73) much as in *Bicyrtes* and other Bembicini; dorsal surface much more convex than the ventral; pleural lobes strong, rounded; each segment distinctly divided dorsally into two annulets. Integument superficially smooth, but actually minutely spinulose anteriorly and dorsally (fig. 74). Body with an unusual number of fairly conspicuous setae; the dorsum is more or less evenly clothed with setae, except that they are less abundant beyond the third abdominal segment and beyond this point mostly absent from the anterior annulets; pleural lobes and ventral surface with a few setae, also more sparse posteriorly. Spiracles all about the same size except that the second pair of thoracic spiracles is slightly smaller than the others. Spiracular peritremes divided into small cells; atria lined with concentric rows of spinules (fig. 76).

Head.—Wider than high, width 2.4 mm., height 2.2 mm. (fig. 72). Coronal suture long, but not well pigmented, terminating in a slight depression. Parietal bands indicated by lightly pigmented lines. Front with a pair of lightly pigmented vertical impressions just mesad of the antennal orbits and with a pair of smaller, lightly pigmented, oblique impressions mesad of these; clypeus with oblique brown markings. Antennal orbits relatively small, about 95 μ in diameter; antennae short, about 40 μ long and 30 μ wide (fig. 77). Head capsule with scattered minute punctures; clypeus with numerous punctures, a few of which give rise to minute setae.

Mouthparts.—Width of labrum .93 mm.; anterior margin with a broad and shallow median emargination (fig. 75). Surface of labrum with numerous punctures, many of which give rise to rather large setae; apical margin with a series of barrel-shaped sensilla, about 18 on each side of the median line, the lateral ones recessed somewhat from the margin; margin with four stout bristles medially, laterally fringed with bristles which are directed mesad. Epipharynx densely spinulose except on the sides, which are pigmented and more or less papillose; sensory areas very dark, each with ten pores; there appear to be four additional pores toward the apex medially; space between the two sensory areas devoid of spinules. Mandibles 1.2 mm. long and .56 mm. wide at the base; inner margin with a single well-defined tooth in addition to the apical tooth; outer margin, near the base, with about eight minute setae. Hypopharynx densely spinulose, the spinules slender and almost hair-like. Maxillae (fig. 78) with a number of setae laterally; mesal and upper surface clothed with rather long, flexible spinules; palpi stout, 160 μ in length; galeae slender, somewhat horn-shaped, 140 μ in length. Prementum with numerous setae ventrally and apically; oral surface spinulose; palpi 130 μ long; spinnerets about as long as the palpi, with a subacute lobe at the base of each spinneret.

Material.—Nine specimens collected July 4-23, 1952, at Blackjack Creek, Pottawatomie Co., Kansas (Evans, Lin, & Yoshimoto).

Microbembex monodonta (Say) (Plate XI, figs. 79-84)

Body.—Length 17 mm.; maximum width 5.3 mm. Form much as in *Bicyrtes* and *Stictia*. Each body segment bears a few dorsal setae in an irregular row toward the front of the posterior annulet; there are also a few small setae on the pleural lobes of the thorax and the first few abdominal segments. Integument essentially smooth, but exhibiting broad, flat granules dorsally much as in *Steniolia*.

Head.—Width about 1 mm.; height .95 mm. (fig. 79). Pale, with pigment distributed about as in *Bicyrtes*. Coronal suture short; parietal bands not evident. Front with prominent vertical impressions just mesad of each antennal orbit, and a pair of smaller, oblique impressions in the middle of the front. Antennal orbits about 90 μ in diameter; antennae elongate, about 70 μ long and 20 μ wide (fig. 83). Head capsule with numerous small punctures, some of which give rise to fairly long setae; this includes particularly a vertical series of setae on each side well above the antennae and a group of setae on the lower sides, just above the bases of the mandibles. There is a group of punctures above the epicondyle and the clypeus is well covered with punctures except medially. The anterior lateral corners of the clypeus are papillose.

Mouthparts.—Labrum .49 mm. wide, nearly three times as broad as its median height; apex shallowly emarginate (fig. 82). Surface of labrum with scattered punctures on the apical half, some of the punctures, especially medially, bearing setae; apical margin with numerous closely packed sensilla, difficult to count but apparently about 15 on each side of the median line; margin also with several straight setae medially and the sides fringed with bristles which are directed mesad. Epipharynx papillose, the papillae grading into spinules medio-apically; sensory areas unpigmented, each containing about 8 pores. Mandibles .54 mm. long, .23 mm. wide at the base; inner margin with a large, truncate, molar-like tooth; latero-basal portion of mandible with four stout setae (fig. 80). Hypopharynx strongly spinulose. Maxillae with numerous setae on the sides; lacinial area strongly papillose, the papillae large and flat, those on the margin appearing like spinules which are hooked mesad; palpi stout, 90 μ long; galeae smaller, 80 μ long (fig. 81). Prementum extensively papillose and with some strong setae ventrally and apically; labial palpi about 70 μ long; spinnerets rather slender, about the same length as the palpi (fig. 84).

Material.—Described from 12 specimens collected as follows: 6 from Oswego Co., N. Y., June-Aug., 1954-55 (Evans, Lin, & Yoshimoto); 4 from Pottawatomie Co., Kansas, Aug. 1952 (H. E. Evans); 1 from Stafford Co., Kansas, July 10, 1953 (H. E. Evans); 1 from Dare Co., N. C., July 11, 1950 (K. V. Krombein).

Microbembex sulphurea (Spinola)

Claude-Joseph (1928, Ann. Sci. Nat. Zool., 11: 116) included drawings and a brief description of the larva in his study of the biology of this South American species. It is interesting to note that the antennae are apparently unusually long in this species, as they are in *monodonta*. His sketches and descriptions are otherwise too superficial to be of much value.

Genus **BEMBIX** Fabricius

The larvae of nine species of *Bembix* are available to us, all in series, affording an opportunity to study the nature of specific differences in this genus. While not all of the species can be clearly separated on larval characters, many of them can. Such larval differences as do occur seem to parallel closely certain ethological differences which will be pointed out in another paper. Two of the species, *troglodytes* and *texana*, have galeae so different from all other Bembicini that one might easily place them in a different tribe if he allowed himself to be strongly influenced by larval characters. A table of larval characters of the genus *Bembix* is presented below.

Grandi has described the larvae of three European species of this genus, and a few notes are presented on these species at the end of the North American species. Grandi failed to note the presence of body setae in these species, but I suspect they are present but very small, as in most American species. The larva of *integra* differs considerably from the other known species of the genus in characters of the labrum and epipharynx, and would almost seem to be a *Stictiella* on the basis of larval characters. All three European species have the mandibles rather more distinctly tridentate or even quadridentate than do any of the North American species.

Table of Larval Characters of the Species of Bembix

A. Galeae larger and longer than the maxillary palpi and terminating in numerous small sensilla (figs. 103, 107); apical margin of labrum with 16-18 sensilla on each side of the median line.

B. Anterior tentorial arms reaching to a point opposite the middle of the antennal orbits ..... *troglodytes* Handlirsch

BB. Anterior tentorial arms reaching to a point opposite the lower margin of the orbits ..... *texana* Cresson

AA. Galeae much more slender and not longer than the maxillary palpi, terminating in two minute sensillla (figs. 93, 95); apical margin of labrum with 12-16 sensilla on each side of the median line.

B. Body setae fairly abundant and conspicuous; head with numerous setae, including some on the front above the antennal orbits (fig. 88).

C. Antennae about twice as long as thick, when appressed not reaching the rim of the orbit (fig. 91) ..... *pruinosa* Fox

CC. Antennae slightly more than twice as long as thick, when appressed reaching the rim of the orbit (fig. 86). *occidentalis beutenmulleri* Fox

BB. Body setae sparse and very inconspicuous; front without noticeable setae above the orbits (figs. 94, 98).

C. Epipharyngeal sensory areas connected by a broad pigmented band (fig. 99); front with a dark bar just mesad of each antennal orbit and a dark spot at the upper end of each parietal band (fig. 98) ..... *belfragei* Cresson

CC. Epipharyngeal sensory areas with the space between them unpigmented (as in fig. 90); markings on front not as above (fig. 94) ... *spinolae* Lepeletier, *comata* Parker, *sayi* Cresson, and *cinerea* Handlirsch

Bembix pruinosa Fox (Plate XII, figs. 88-93)

Body.—Length 25 mm.; maximum width 7.5 mm. (fig. 89). Dorsum much more convex than venter; pleural lobes strong, the intersegmental lines incompletely obliterated between them. Integument smooth. Posterior annulet and pleural lobes of each body segment with numerous rather inconspicuous setae; each segment with a few very inconspicuous setae ventrally. Prothoracic spiracles very slightly larger than the others; structure of the spiracular atria very much as figured for *Stictia carolina,* except that the peritreme is less distinctly divided into cells.

Head.—Wider than high, width 1.75 mm.; height 1.64 mm. (fig. 88). Front with a vertical impression just mesad of each antennal orbit and also impressed medially at the end of the coronal suture, again just below this, and again at the epistomal suture. A brownish blotch occupies the area between the antennae and the anterior tentorial arms and pleurostomal thickenings, which are dark brown. Parietal bands represented by faint brownish lines. Antennal orbits 115 μ in diameter; antennae 45 μ long and 25 μ wide near the base (fig. 91). Front with widely scattered punctures, some of which bear minute setae and a few of which (including several just above and mesad of the parietal bands and several just above the mandibular bases) bear somewhat larger setae.

Mouthparts.—Labrum .62 mm. wide, its apical margin shallowly emarginate (fig. 90). Surface of labrum with scattered punctures, many of which give rise to fairly long setae; apical margin with a row of barrel-shaped

sensilla, of which there are about 16 on each side of the median line (there seems to be much intraspecific variation in the actual arrangement of these sensilla); median portion with a few straight setae, the sides roughly fringed with bristles which are directed mesad. Epipharynx with short spinules basally, laterally papillose and somewhat pigmented, anteriorly with longer spinules; sensory areas dark brown, each with about ten pores, the two sensory areas connected by an unpigmented band which is devoid of spinules. Mandibles .9 mm. long and .4 mm. wide at the base; inner margin with a single tooth and a slight sinuation between this tooth and the apical one; outer margin, near the base, with about ten setae. Hypopharynx densely spinulose. Maxillae with numerous setae on the sides; lacinial area densely clothed with rather flexible bristles; palpi 105 μ long, about 45 μ wide at the base, terminating in several sensory cones; galeae horn-shaped, about the same length as the palpi but much more tapered apically, terminating in two small sensilla (fig. 93). Prementum with numerous setae ventrally and apically; upper surface spinulose toward the base medially; spinnerets somewhat flaring, about 110 μ long; palpi about 100 μ long, terminating in five sensilla (fig. 92).

Material.—22 specimens collected by the writers as follows: 18 in Reno Co., Kansas, July-Aug. 1953; 3 in Stafford Co., Kansas, July 1953; 1 in Oswego Co., N. Y., July 29, 1954.

Bembix occidentalis beutenmulleri Fox (Plate XI, figs. 85-87)

Body.—Length 27 mm.; maximum width 8 mm. Characters as in *pruinosa,* except that body setae are somewhat more abundant, including some setae on the anterior annulets of the abdominal segments.

Head.—Width 1.8 mm.; height 1.65 mm. Antennal orbits 120 μ in diameter; antennae 55 μ long, 23 μ wide near the base, reaching the rim of the orbit when appressed (fig. 86). Otherwise as in *pruinosa.*

Mouthparts.—Labrum .66 mm. wide, the anterior margin shallowly emarginate; details as in *pruinosa* except that only 13 sensilla can be counted on each side of the median line. Epipharynx, mandibles, and maxillae as in *pruinosa;* maxillary palpi and galeae each about 100 μ long, the latter much more slender and tapering (fig. 87). Labial palpi 80 μ long; spinnerets protruding well beyond the palpi, about 100 μ in length.

Material.—10 specimens, all from near Antioch, Contra Costa Co., Calif., 3 from cocoons collected by E. S. Ross in March, 1954, and 7 collected on Aug. 15, 1954, by H. E. and M. A. Evans.

Bembix spinolae Lepeletier (Plate XIV, fig. 108)

Body.—Length 22 mm.; maximum width 6 mm. Body setae moderately abundant, distributed as in *pruinosa,* although short and inconspicuous. First thoracic spiracles larger than second.

Head.—Width 1.6 mm.; height 1.5 mm. Features as in *pruinosa,* including pigment spots of about the same extent beneath each antenna. Parietal bands fairly long, but weak and unpigmented. Punctures of front and clypeus about as in *pruinosa,* those on the lower sides of the head bearing fairly long setae, but the others bearing minute setae or none at all. Antennal orbits 100 μ in diameter; antennae 50 μ long, 25 μ in maximum diameter. Anterior tentorial arms fairly long, reaching nearly to the bases of the antennal orbits.

Mouthparts.—Labrum .6 mm. wide, the apex barely emarginate; margin with about 12 sensilla on each side of the median line; epipharyngeal sensory areas consisting of two transverse pigmented patches, each containing about ten pores; there is a faint indication of a median connection between the two areas. Mandibles as described for *pruinosa.* Maxillary palpi 105 μ long; galeae 100 μ long, slender and horn-shaped (fig. 108). Labial palpi 75 μ long; spinnerets about 100 μ long, each with a somewhat irregular lobe at the base.

Material.—13 specimens collected by the authors as follows: 7 from Stafford Co., Kansas, July 8-20, 1953-54; 3 from Reno Co., Kansas, July 21-22, 1953; 1 from Kearny Co., Kansas, Aug. 20, 1952; 2 from Oswego Co., N. Y., Aug. 2, 1954.

Bembix comata Parker

Body.—Length 24 mm.; maximum width 6.8 mm. First thoracic spiracles greater than second as 3 : 2. Body setae very sparse, short, and inconspicuous.

Head.—Width 1.6 mm.; height 1.5 mm. Antennal orbits 110 μ in diameter; antennae 50 μ long and 25 μ in maximum diameter. Otherwise as in *spinolae.*

Mouthparts.—Labrum .62 mm. wide, its apex barely emarginate; margin with 12 well-defined barrel-shaped sensilla on each side. The epipharyngeal sensory areas appear to be slightly connected medially, as in *spinolae.* Mandibles with a weak third tooth. Maxillary palpi 110 μ in length; galeae slender and tapering, 95 μ in length. Labial palpi 75 μ in length, exceeded by the spinnerets, which are about 100 μ in length.

Material.—Described from 3 specimens collected by H. E. and M. A. Evans at Alameda, Calif., Aug. 12-16, 1954.

Bembix cinerea Handlirsch (Plate XIV, fig. 109)

Body.—Length 28 mm.; maximum width 8.5 mm. Body setae extremely sparse and weak, but distributed much as in *pruinosa.* First thoracic spiracles larger than the others.

Head.—Width 1.55 mm.; height 1.5 mm. Pigment spot below the antennae well-defined and dark. Roughening of the top of the head capsule unusually conspicuous; head with the usual small punctures, only those on

the lower sides bearing noticeable setae. Antennal orbits 105 μ in diameter, the antennae 50 μ long and 25 μ in maximum thickness. Anterior tentorial arms as in *spinolae*.

Mouthparts.—Labrum .63 mm. wide, the anterior margin feebly emarginate, provided with about 14 sensilla on each side of the median line; epipharyngeal sensory areas each with about 10 pores, the median connection between the two areas evident but barely pigmented. Mandibles as in *pruinosa*. Maxillae (fig. 109) with the palpi and galeae each about 115 μ long, the galeae more slender and tapering. Labial palpi 80 μ long, the spinnerets about 100 μ long.

Material.—10 specimens collected near Flamingo, Everglades National Park, Florida, March-April, 1954-55 (H. E. and M. A. Evans and C. M. Yoshimoto). A brief description of this colony of *cinerea* has been published by Krombein and Evans (1955, Proc. Ent. Soc. Wash., 57: 233-234).

Bembix sayi Cresson (Plate XIII, figs. 94-97)

Body.—Length 29 mm.; maximum width 8.5 mm. Spiracles all about the same size except the second thoracic, which are slightly smaller. Setae weak and inconspicuous, but distributed about as in *pruinosa*. Each posterior annulet with a small transverse welt-like elevation, interrupted medially.

Head.—Width 1.75 mm.; height 1.6 mm. (fig. 94). A large, somewhat triangular brownish spot is situated below and mesad of the antennal orbits; there are also vague paired spots on the middle of the front and on the clypeus. Punctures distributed about as in other species of the genus, those on the lower sides of the head, above the mandibles, bearing short setae. Parietal bands indicated by faint lines close to the orbits. Antennal orbits 100 μ in diameter; antennae about 50 μ long and 25 μ in maximum thickness (fig. 96). Anterior tentorial arms fairly long, curved, reaching to a point level with the bottoms of the orbits.

Mouthparts.—Labrum .66 mm. wide, its anterior margin shallowly emarginate and provided with the usual row of sensilla, of which there are about 14 on each side of the median line; epipharyngeal sensory areas as in the preceding species. Mandibles with one distinct tooth in addition to the apical tooth, and with two other slight sinuations, making the mandibles very indistinctly quadridentate. Maxillae (fig. 95) with the palpi about 110 μ long; galeae nearly as long, but more tapering apically. Labium (fig. 97) with the palpi 90 μ long, slightly exceeding the spinnerets, which are about 110 μ long.

Material.—6 specimens, 5 collected at the Archbold Biological Station, Lake Placid, Florida, May 8-10, 1955 (H. E. & M. A. Evans), and 1 collected at Sun City, Kansas, July 22, 1953 (C. M. Yoshimoto).

Bembix belfragei Cresson (Plate XIII, figs. 98-101)

Body.—Length 27 mm.; maximum width 7.5 mm. Spiracles all about the same size except the second thoracic, which are slightly smaller. Body setae nearly absent; on close examination a few weak setae can be seen on the pleural lobes and posterior annulets. Each posterior annulet with a transverse, welt-like elevation. Supra-anal lobe slightly protuberant.

Head.—Width 1.7 mm.; height 1.6 mm. (fig. 98). Area below the antennae lightly pigmented, as in the other species, but with a vertical dark bar just mesad of each antennal orbit, and most specimens with a small dark spot at the upper end of each parietal band. Punctures distributed as in the other species, a few of those on the lower sides of the head giving rise to small setae. Antennal orbits 120 μ in diameter; antennae 50 μ long, 25 μ in maximum thickness (fig. 100). Anterior tentorial arms short and straight, not reaching the orbits.

Mouthparts.—Labrum .65 mm. wide, its apical margin with only a small median notch, and with about 14 rather small sensilla on each side of the median line (fig. 99). Epipharyngeal sensory areas large and heavily pigmented, connected by a broad, transverse, pigmented band. Mandibles as in *sayi*. Maxillary palpi about 105 μ long; galeae about the same length, much more tapered apically. Labium (fig. 101) with the palpi about 80 μ long, slightly exceeded by the spinnerets; spinules on the oral surface of the prementum grading into papillae laterally.

Material.—18 specimens collected by Evans, Lin, and Yoshimoto at Little Gobi Desert, Pottawatomie Co., Kansas, June-July, 1953.

Bembix troglodytes Handlirsch (Plate XIV, figs. 102-104)

Body.—Length 24 mm; maximum width 6.5 mm. Each segment with a band of fairly conspicuous setae on the anterior part of the posterior annulet; pleural lobes and venter with inconspicuous setae. Anterior portion of each posterior annulet with a transverse elevation, more noticeable in specimens not fully grown; such specimens have the appearance of having three dorsal annulets. First thoracic spiracles slightly larger and the second thoracic spiracles slightly smaller than the abdominal spiracles.

Head.—Width 1.6 mm.; height 1.45 mm. (fig. 102). Head capsule with the usual small punctures, only those on the lower sides bearing noticeable setae. Anterior tentorial arms unusually long, curved, reaching to a point opposite the middle of the antennal orbits. Orbits 105 μ in diameter; antennae about 40 μ long and 20 μ wide.

Mouthparts.—Labrum .58 mm. wide, its anterior margin shallowly emarginate and with about 16 barrel-shaped sensilla on each side of the median line (fig. 104). Epipharyngeal sensory areas each with about 8 pores; space between the two sensory areas bare of spinules and unpigmented. Inner margin of mandibles with a single well-defined tooth in addition to the

apical tooth. Maxillae (fig. 103) with numerous lateral setae; palpi 125 μ long, about 60 μ in maximum width, terminating in 5 small sensilla; galeae 150 μ long, about 80 μ in maximum width, the apex rounded and bearing about 10 sensilla. Labial palpi about 90 μ in length, considerably exceeded by the spinnerets, which are about 110 μ in length.

Material.—13 specimens collected by the writers as follows: 10 from Blackjack Creek, Pottawatomie Co., Kansas, July 3-Aug. 13, 1952-1954; 1 from Reno Co., Kansas, Aug. 14, 1953; 1 from Scott Co., Kansas, Aug. 21, 1952; and 1 from Kearny Co., Kansas, July 12, 1954.

Bembix texana Cresson (Plate XIV, figs. 105-107)

Body.—Length 29 mm.; maximum width 8 mm.; features as described for *troglodytes,* except that setae are generally more abundant and conspicuous.

Head.—Width 1.8 mm.; height 1.7 mm. Punctures rather sparse, only those on the lower sides of the head bearing noticeable setae. Anterior tentorial arms curved, but shorter than in *troglodytes,* reaching only to the bottoms of the orbits. Orbits 120 μ in diameter; antennae about 40 μ long and 20 μ in maximum thickness (fig. 106).

Mouthparts.—Labrum .68 mm. wide, its apical margin with a broad, V-shaped emargination; margin with about 18 small sensilla on each side; epipharynx as in *troglodytes.* Maxillae as in *troglodytes* and as shown in fig. 107; palpi 110 μ long and 50 μ in maximum width; galeae 145 μ long and 70 μ in maximum width, bearing about 10 small sensilla. Labial palpi 80 μ long; spinnerets about 110 μ long (fig. 105).

Material.—Three specimens collected by H. E. and M. A. Evans at Highlands Hammock State Park, Florida, May 10, 1955.

Bembix integra Panzer

Grandi (1926, Boll. Lab. Zool. Portici, 19: 303-306) has described the larva of this European species. There appear to be a large number of setae scattered over the labrum; the epipharynx is spinulose over its entire surface, even between the sensory areas and on the sides. The galeae are shorter and more slender than the maxillary palpi, as in most American species. In other features, including the antennae and mandibles, *integra* appears close to such American species as *spinolae.*

Bembix oculata Latreille

Grandi has also described the larva of this European species (1926, Mem. Soc. Ent. Italiana, 5: 190-192). The labrum and epipharynx agree very closely with such American species as *pruinosa, spinolae,* and others; there are scattered setae toward the apical margin of the labrum, and about 15

sensilla along the apical margin on each side of the median line; the epipharynx is papillose laterally and devoid of spinules between the two sensory areas. The mandibles are weakly quadridentate. The galeae and palpi are about as in *integra*.

Bembix olivacea Cyrillo

Grandi (1928, Boll. Lab. Ent. Bologna, 1: 16-17) describes this species as being very similar to *integra* and *oculata*. The labrum is very similar to *oculata*, and the epipharynx appears to differ only in having the papillae on the sides somewhat more pointed. The mandibles are rather distinctly tridentate. The maxillae and labrum do not differ notably from those of *oculata*.

Explanation of Figures

In some of the drawings of the head, the anterior aspect is shown on the left side, the posterior aspect on the right side. In all figures of the labrum, the upper surface is shown on the left side, the under surface (epipharynx) on the right side. In most figures of the apex of the labium only the right half is shown or, in some cases, the dorsal surface is shown on the right, the ventral on the left.

Plate II

Fig. 1.—*Alysson melleus* Say. Head, anterior aspect.
Fig. 2.—Same, lateral aspect of head.
Fig. 3.—Same, lateral aspect of body.
Fig. 4.—Same, labrum and epipharynx.
Fig. 5.—Same, apex of maxilla.
Fig. 6.—Same, antenna.
Fig. 7.—Same, apex of labium.
Fig. 8.—*Nysson daeckei* Viereck. Head.
Fig. 9.—Same, antenna.
Fig. 10.—Same, lateral aspect of body.

Plate III

Fig. 11.—*Nysson daeckei* Viereck. Labrum and epipharynx.
Fig. 12.—Same, apex of maxilla.
Fig. 13.—*Gorytes canaliculatus* Packard. Head.
Fig. 14.—Same, antenna.
Fig. 15.—Same, spiracle.
Fig. 16.—Same, labrum and epipharynx.
Fig. 17.—Same, body.
Fig. 18.—Same, apex of maxilla.
Fig. 19.—Same, mandible.
Fig. 20.—Same, apex of labium.

PLATE IV

Fig. 21.—*Gorytes asperatus* Fox. Labrum.
Fig. 22.—Same, antenna.
Fig. 23.—*Ochleroptera bipunctata* (Say). Head.
Fig. 24.—Same, antenna.
Fig. 25.—Same, body.
Fig. 26.—Same, labrum and epipharynx.
Fig. 27.—Same, apex of maxilla.
Fig. 28.—Same, mandible.
Fig. 29.—Same, apex of labium.

PLATE V

Fig. 30.—*Sphecius speciosus* (Drury). Head.
Fig. 31.—Same, antenna.
Fig. 32.—Same, body.
Fig. 33.—Same, labrum and epipharynx.
Fig. 34.—Same, apex of maxilla.
Fig. 35.—Same, apex of labium.
Fig. 36.—Same, spiracle.

PLATE VI

Fig. 37.—*Bembecinus neglectus* (Cresson). Head.
Fig. 38.—Same, antenna.
Fig. 39.—Same, body.
Fig. 40.—Same, labrum and epipharynx.
Fig. 41.—Same, apex of maxilla.
Fig. 42.—Same, apex of labium.
Fig. 43.—*Psammaecius nebulosus* (Packard). Body of diapausing larva.
Fig. 44.—Same, labrum and epipharynx.

PLATE VII

Fig. 45.—*Bicyrtes quadrifasciata* (Say). Head.
Fig. 46.—Same, antenna.
Fig. 47.—Same, body.
Fig. 48.—Same, labrum and epipharynx.
Fig. 49.—Same, mandible.
Fig. 50.—Same, spiracle.
Fig. 51.—Same, apex of labium.
Fig. 52.—Same, apex of maxilla.

PLATE VIII

Fig. 53.—*Bicyrtes fodiens* (Handlirsch). Labrum and epipharynx.
Fig. 54.—Same, antenna.
Fig. 55.—Same, mandible.
Fig. 56.—*Bicyrtes ventralis* (Say). Labrum and epipharynx.

Fig. 57.—Same, antenna.
Fig. 58.—Same, mandible.
Fig. 59.—*Stictiella serrata* (Handlirsch). Head.
Fig. 60.—Same, antenna.
Fig. 61.—Same, labrum and epipharynx.
Fig. 62.—Same, apex of maxilla.

PLATE IX

Fig. 63.—*Stictiella pulla* (Handlirsch). Labrum and epipharynx.
Fig. 64.—Same, antenna.
Fig. 65.—Same, mandible.
Fig. 66.—*Steniolia elegans* Parker. Head.
Fig. 67.—Same, labrum and epipharynx.
Fig. 68.—Same, antenna.
Fig. 69.—Same, apex of maxilla.
Fig. 70.—Same, apex of labium.
Fig. 71.—Same, spiracle.

PLATE X

Fig. 72.—*Stictia carolina* (Fabricius). Head.
Fig. 73.—Same, body.
Fig. 74.—Same, integument of dorsal part of prothorax, greatly enlarged.
Fig. 75.—Same, labrum and epipharynx.
Fig. 76.—Same, spiracle.
Fig. 77.—Same, antenna.
Fig. 78.—Same, apex of maxilla.

PLATE XI

Fig. 79.—*Microbembex monodonta* (Say). Head.
Fig. 80.—Same, mandible.
Fig. 81.—Same, apex of maxilla.
Fig. 82.—Same, labrum and epipharynx.
Fig. 83.—Same, antenna.
Fig. 84.—Same, apex of labium.
Fig. 85.—*Bembix occidentalis beutenmulleri* Fox. Apex of labium.
Fig. 86.—Same, antenna.
Fig. 87.—Same, apex of maxilla.

PLATE XII

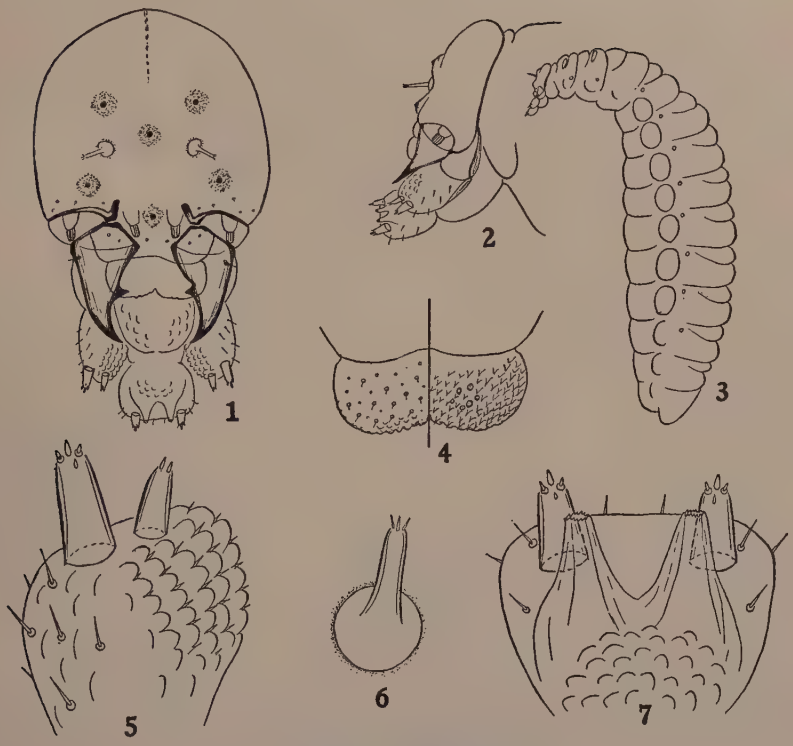
Fig. 88.—*Bembix pruinosa* Fox. Head.
Fig. 89.—Same, body.
Fig. 90.—Same, labrum and epipharynx.
Fig. 91.—Same, antenna.
Fig. 92.—Same, apex of labium.
Fig. 93.—Same, apex of maxilla.

PLATE XIII

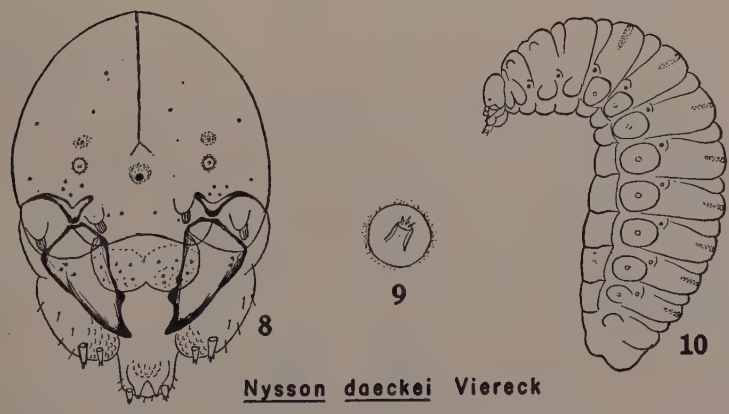
Fig. 94.—*Bembix sayi* Cresson. Head.
Fig. 95.—Same, apex of maxilla.
Fig. 96.—Same, antenna.
Fig. 97.—Same, apex of labium.
Fig. 98.—*Bembix belfragei* Cresson. Head.
Fig. 99.—Same, labrum and epipharynx.
Fig. 100.—Same, antenna.
Fig. 101.—Same, apex of labium.

PLATE XIV

Fig. 102.—*Bembix troglodytes* Handlirsch. Head.
Fig. 103.—Same, apex of maxilla.
Fig. 104.—Same, labrum and epipharynx.
Fig. 105.—*Bembix texana* Cresson. Apex of labium.
Fig. 106.—Same, antenna.
Fig. 107.—Same, apex of maxilla.
Fig. 108.—*Bembix spinolae* Lepeletier. Apex of maxilla.
Fig. 109.—*Bembix cinerea* Handlirsch. Apex of maxilla.

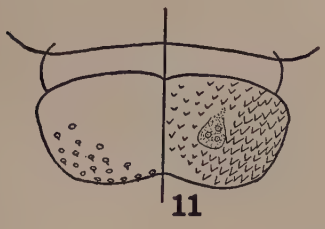


Alysson melleus Say

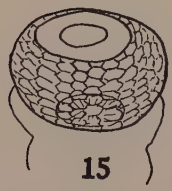


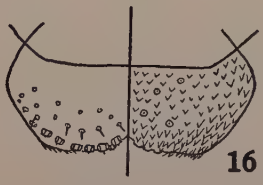
Nysson daeckei Viereck

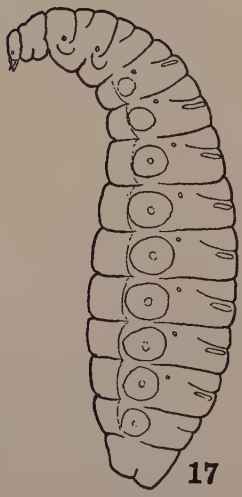
EVANS AND LIN: LARVAE OF DIGGER WASPS

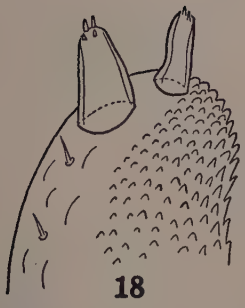


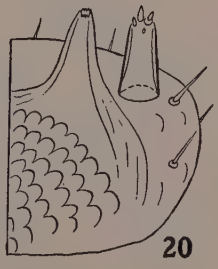
Nysson daeckei Viereck



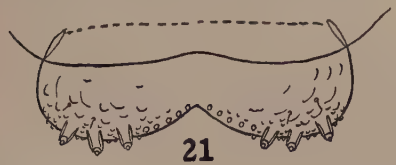




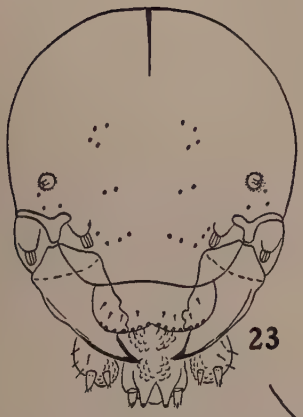


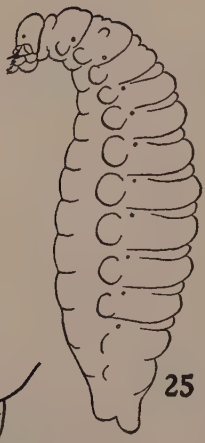


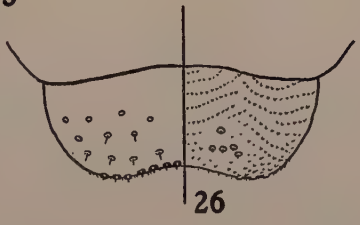
Gorytes canaliculatus Packard

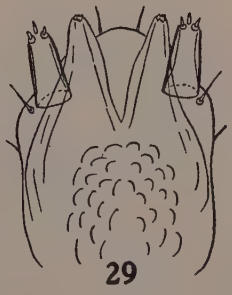


Gorytes asperatus Fox

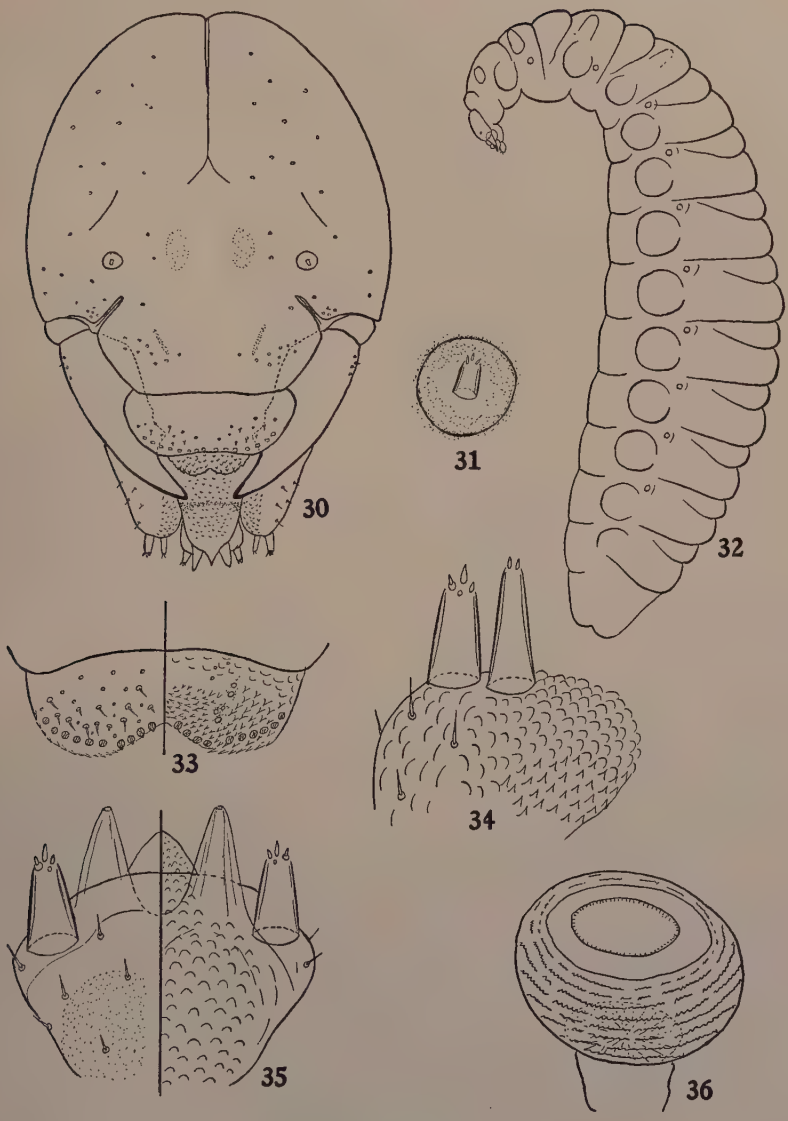




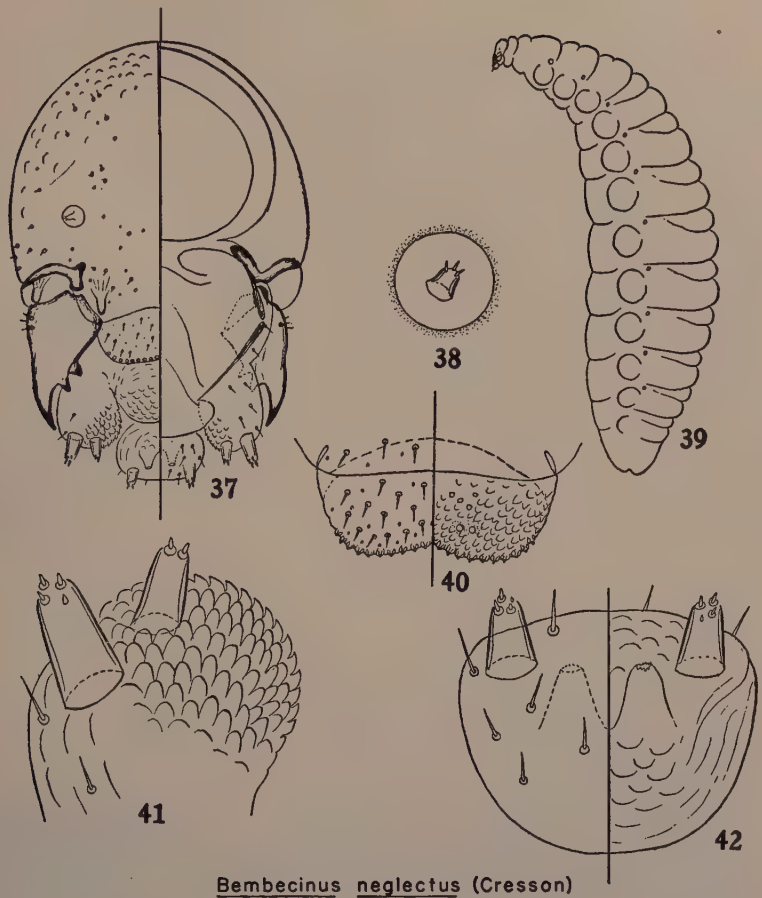




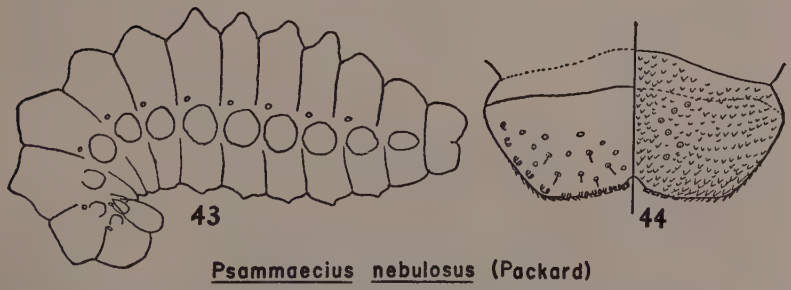
Ochleroptera bipunctata (Say)



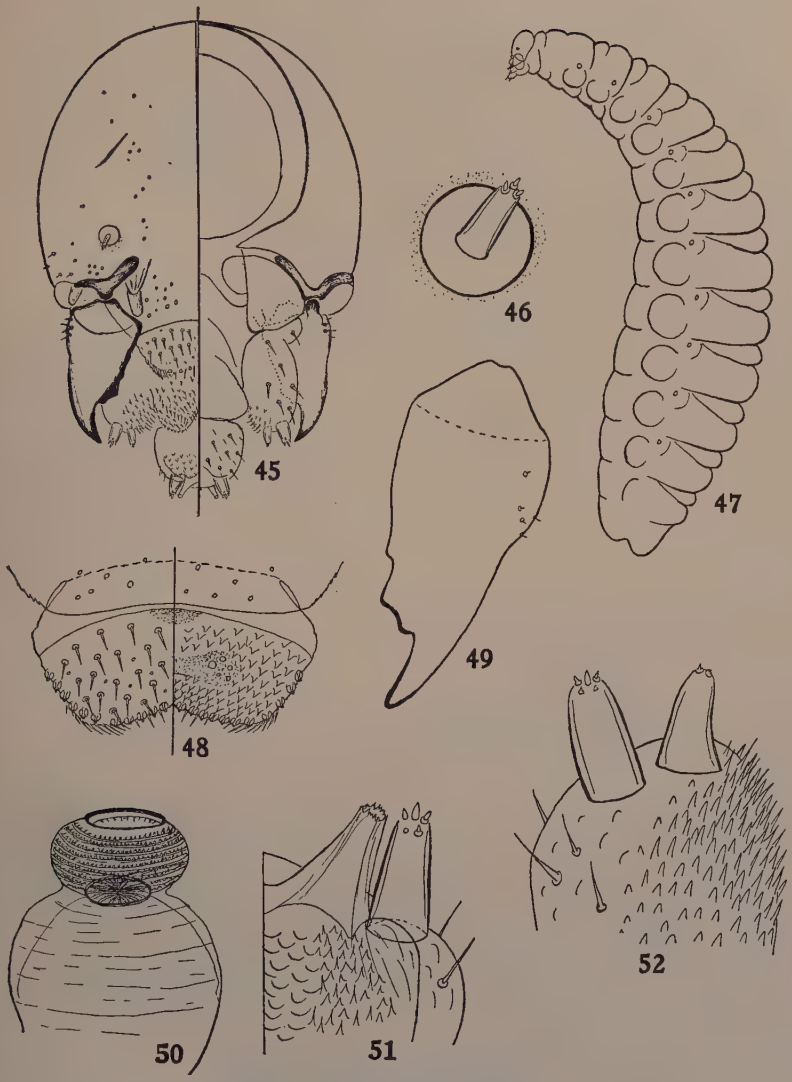
Sphecius speciosus (Drury)



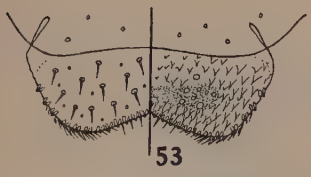
Bembecinus neglectus (Cresson)



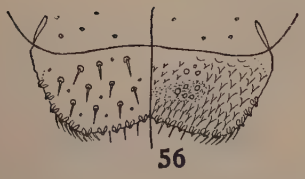
Psammaecius nebulosus (Packard)



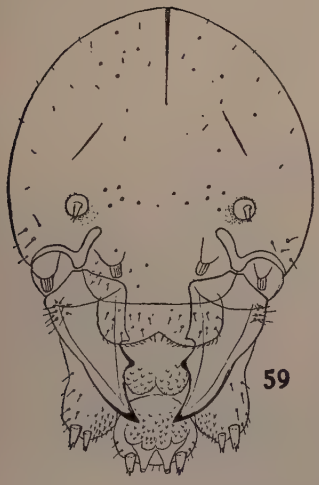
Bicyrtes quadrifasciata (Say)

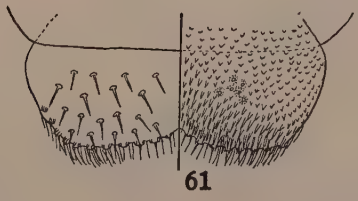


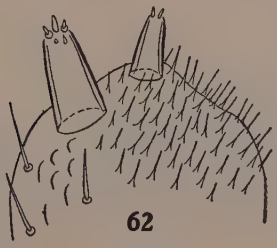
Bicyrtes fodiens (Handlirsch)



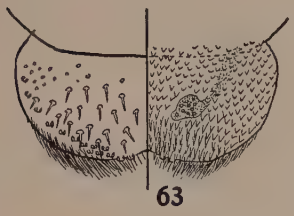
Bicyrtes ventralis (Say)



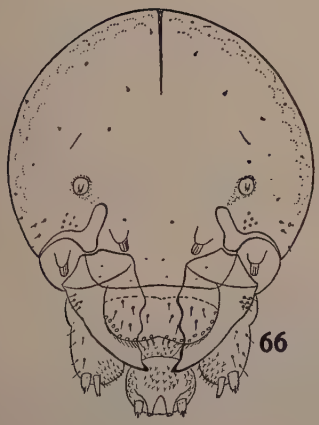


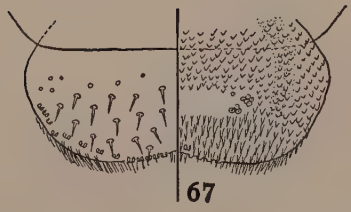


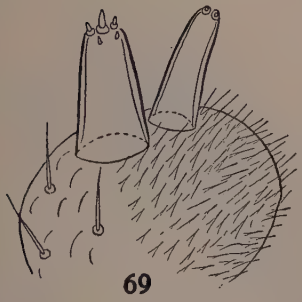
Stictiella serrata (Handlirsch)

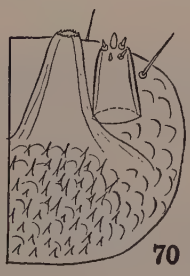


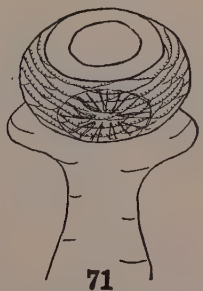
Stictiella pulla (Handlirsch)



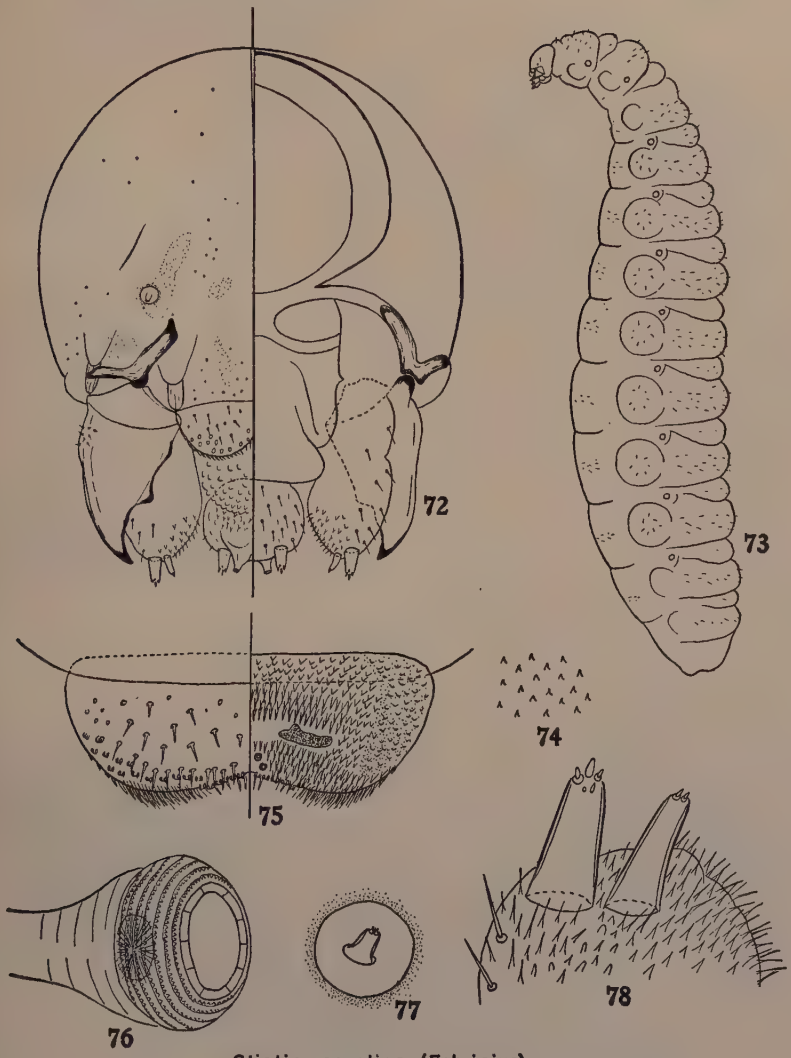




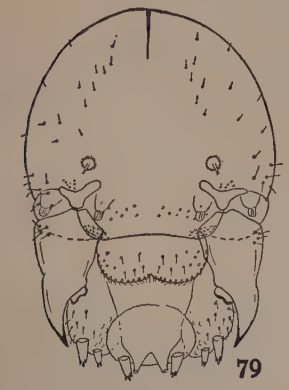


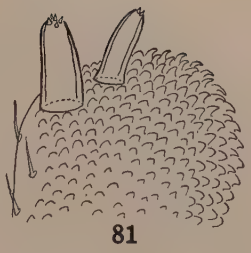


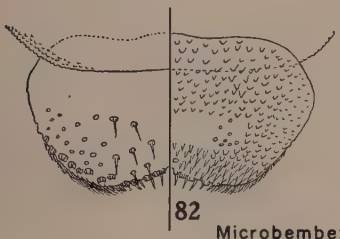
Steniolia elegans Parker

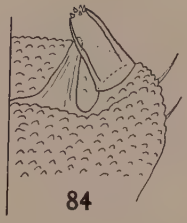


Stictia carolina (Fabricius)

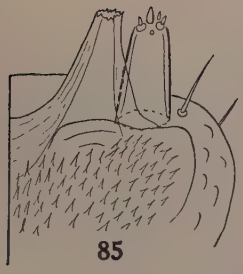


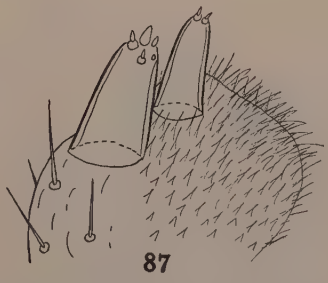






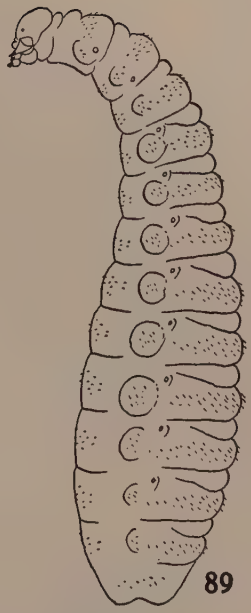
Microbembex monodonta (Say)

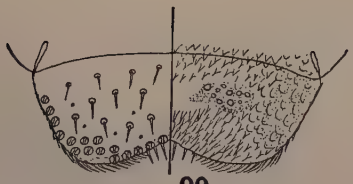




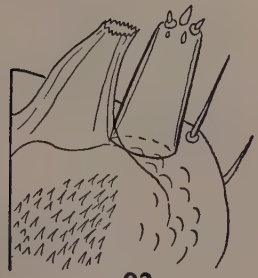
Bembix occidentalis beutenmulleri Fox

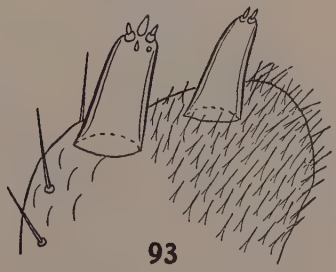
88


89

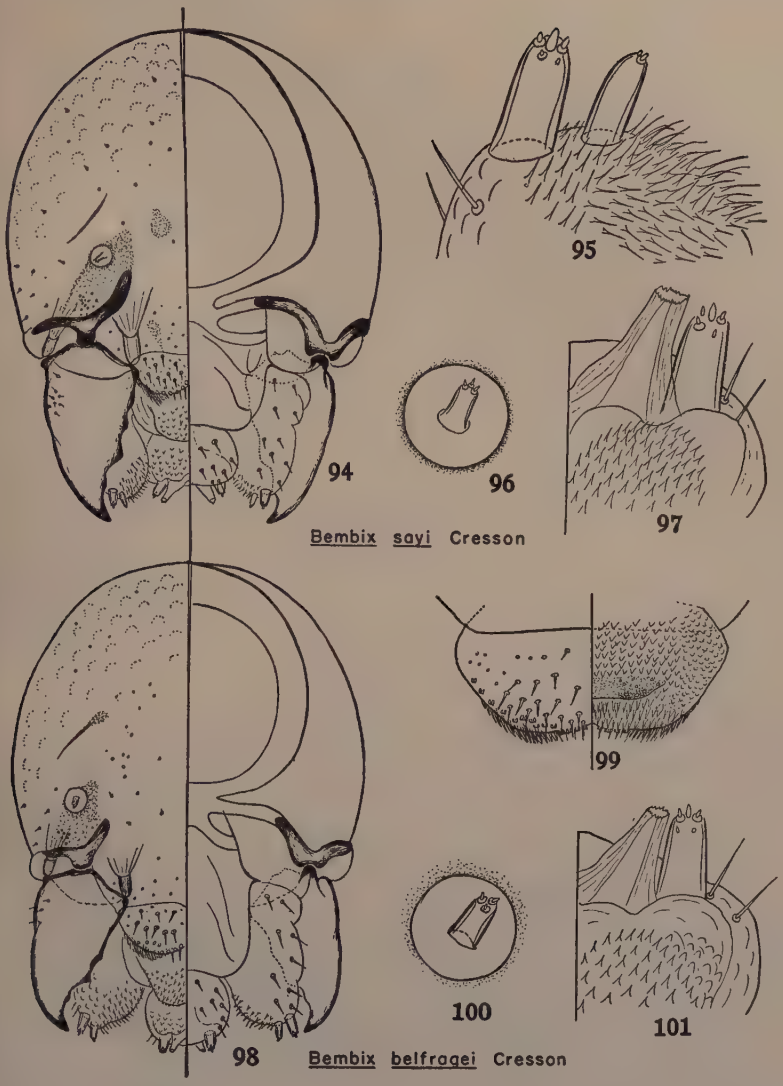

90

91


92

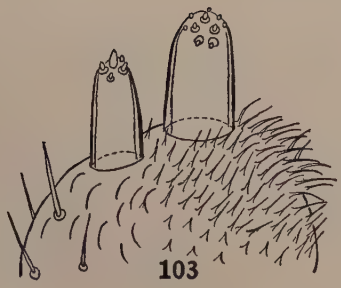

93

Bembix pruinosa Fox

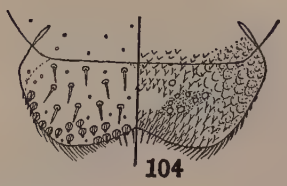


EVANS AND LIN: LARVAE OF DIGGER WASPS

102



103

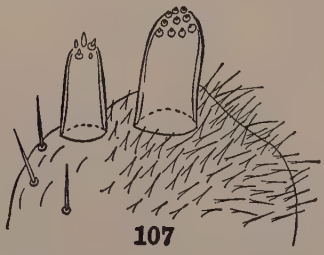


104

Bembix troglodytes Handlirsch

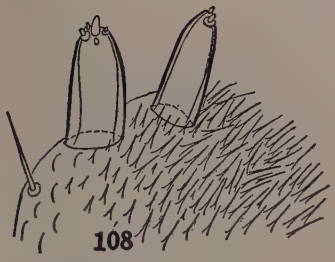
105

106



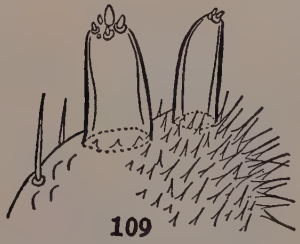
107

Bembix texana Cresson



108

Bembix spinolae Lepeletier



109

Bembix cinerea Handlirsch

THE TAXONOMY OF BATRACHIDEA, PUIGGARIA, LOPHOSCIRTUS, EUTETTIGIDEA AND REHNIDIUM N. GEN.

(ORTHOPTERA; ACRIDOIDEA; TETRIGIDAE)

BY HAROLD J. GRANT, JR.

Assistant Curator of Entomology,
Academy of Natural Sciences of Philadelphia

The present paper is the third in a series [1] devoted to revisionary studies of batrachideine genera. The genera discussed herein have been very poorly known and in the majority of cases were insufficiently described and unfigured. The work has been made possible through the cooperation of Dr. George Wallace of the Carnegie Museum, Pittsburgh and Dr. Larry Quate of the University of Nebraska Museum, Lincoln, who have loaned me the exotic tetrigid collections of Lawrence Bruner. These, along with that part of the Bruner collection now in the Academy's series and the entire Hancock collection also housed in Philadelphia, have allowed me to see nearly all the material previously reported in the literature. I am further indebted to Drs. Cazier, Gurney, Hubbell and Ross for the loan of specimens in collections under their care. Various other persons who have helped are mentioned at appropriate places in the text.

Of the previously described species discussed on the following pages, I have seen the types of all except two. One of these is presumed lost (*Batrachidea mucronata* Audinet-Serville) and sketches of material now before me have been compared with the other (*Puiggaria antennata* Bolívar. See discussion under this species.). Seven species and one genus are described here for the first time.

Following the plan of the preceding papers in this series, I have not aligned the genera in a phylogenetic order of relationship,

[1] For the preceding works see Grant, H. J., Jr. 1955. Notulae Naturae no. 275, Acad. Nat. Sci. Phila. and 1955. Proc. Acad. Nat. Sci. Phila. CVII: 57-74.

preferring to do this in a planned synopsis of the subfamily. Accordingly, the present contribution is almost entirely descriptive in content.

Ownership of the specimens reported in this paper is indicated by the following symbols: A.M.N.H.—American Museum of Natural History; A.N.S.P.—Academy of Natural Sciences of Philadelphia; C.A.—California Academy of Sciences; C.M.—Carnegie Museum; U.M.Z.—University of Michigan Museum of Zoology; U.N.M.—University of Nebraska Museum; U.S.N.M.—United States National Museum.

BATRACHIDEA Audinet-Serville

1839, *Tetrix* (Batrachidea) Audinet-Serville, Hist. Nat. Ins. Orth.: 764. 1792, *Tetrix* Latreille; Audinet-Serville, Encycl. Meth. VII: 600. 1825, *Tetrix* Latreille; Audinet-Serville, Encycl. Meth. X: 600. 1887, *Batrachidea* Audinet-Serville; Bolivar, Ann. Soc. Ent. Belg. XXXI: 229-300. 1906, *Batrachidea* Audinet-Serville; Hancock, Gen. Insectorum, Fasc. 48: 70. 1910, *Batrachidea* Audinet-Serville; Bruner, Ann. Carn. Mus. VII: 141. 1921, *Batrachidea* Audinet-Serville; Bruner, Ann. Carn. Mus. XIII: 16. (Not the *Batrachidea* of Scudder, Thomas and Saussure.)

Genotype (monotypy) *Batrachidea mucronata* Audinet-Serville.

This small genus has hitherto been very poorly known and its species have, for the most part, been superficially described and inadequately or not at all figured. Collections are still small in all but the genotypic species. All species are herein figured and whenever necessary redescribed. Two additional species are described and two names placed in the synonymy.

Diagnosis.—The genus may be recognized and differentiated from others in the subfamily because of its generally robust body form, medium size, stout and weakly decurved pronotal spine and approximately truncate apex of the female subgenital plate. It is quite closely related to *Scaria*, slightly less so to *Rehnidium* n. g. (here described) and *Tettigidea*. It could be most easily confused with *Tettigidea* because of its generally similar body form, but the flatter pronotum (in outline), cristate lateral carinae of the frontal costa and the presence of a stout and decurved pronotal spine will serve to separate it from that taxon. It could also be mistaken, in its macropronotal condition, for *Paurotarsus*, but the high, domed vertex and lack of pronotal spine in that genus allows ready and accurate determination.

Generic characters.—Size medium for the subfamily; form usually robust; surface variable, usually coarsely granulose, occasionally with larger nodules, or smoother. Vertex lower than dorsal surface of eyes. Fastigium truncate, on approximately same line as anterior border of eyes. Frontal costa protruding before eyes in lateral aspect. Pronotum moderately tectate; spined anteriorly; anterior carinae prominent; brachypronotal or macropronotal. Tegmina usually maculate. Median femora usually with apical spine. Posterior femora incrassate. Female subgenital plate approximately truncate in medio-apical portion. Male ninth abdominal sternite [2] truncate or weakly emarginate.

The known range of the genus extends from north central Colombia (Santander) in the north, west to Peru (Junín) and south to Paraguay (Concepcion) and Brazil (Rio de Janeiro). Its northeastern limit is Pará, Brazil. *Batrachidea* is another of the Orinoco-Amazonian Basin genera, whose range also includes the eastern Brazilian highlands of Minas Geraes and Rio de Janeiro. The statement of Hancock in the Genera Insectorum (see above) concerning the West Indian distribution of the genus is unfounded and possibly based on a misinterpretation of Bolívar's record of *B. flavonotata* from "Nueva Granada" which is present day Colombia.

Key to the Species of *Batrachidea* Audinet-Serville

1. Median femora with a well-developed, internal, dorso-apical spine; frontal costa protruding before the eyes equally in upper and lower halves, arcuate or subarcuate in outline 2
   Median femora with apical spine obsolete or missing; frontal costa protruding further before the eyes in lower half, not arcuate in outline .. 3
2. Median pronotal carina moderately cristate, low; lateral carinae of frontal costa divergent, clearly sulcate between 4
   Median pronotal carina sharply cristate, high and thin; lateral carinae of frontal costa closely appressed, scarcely sulcate between; male ninth abdominal sternite as in fig. 1, F. (Based on male only.)
   Batrachidea vesca n. sp.
3. Tegmina with a large, subapical, flavous cicatrix; anterior carinae of pronotum substraight, weakly divergent caudad; median femora with an obsolete, internal, dorso-apical spine.
   Batrachidea flavonotata Bolívar
   Tegmina immaculate; anterior pronotal carinae concave, weakly convergent caudad; median femora lacking the apical spine. (Based on females only.) ..... *Batrachidea inermis* Hebard

[2] This structure is erroneously referred to as the eighth abdominal sternite in the two earlier papers in this series.

4. Dorsal terminus of frontal costa on a level with, or slightly higher than, the dorsal surface of the eyes; tegmina with a large, subapical, flavous cicatrix; pronotal anterior carinae convergent caudad.

Batrachidea macella n. sp.

Dorsal terminus of frontal costa not reaching same level as dorsal surface of eyes; tegmina with a small flavous or brown subapical macula; anterior pronotal carinae divergent caudad.

Batrachidea mucronata (Audinet-Serville)

Batrachidea mucronata Audinet-Serville Plate XV, fig. 1.

1792, *Tetrix mucronata* Audinet-Serville, Encycl. Meth. VII: 600. 1839, *Tetrix* (*Batrachidea*) *mucronata* Audinet-Serville, Hist. Nat. Ins. Orth.: 764. 1887, *Batrachidea mucronata* Audinet-Serville; Bolívar, Ann. Soc. Ent. Belg. XXXI: 300. 1898, *Batrachidea mucronata* Audinet-Serville; Giglio-Tos, Boll. Mus. Zool. Anat. Comp. Torino XIII(311): 36. 1906, *Batrachidea notata* Hancock, in Bruner, Proc. U. S. Nat. Mus. XXX: 616-617 (new synonym). 1910, *Tettigidea gracilicornis* (in part); Bruner, Ann. Carn. Mus. VII: 128-129 (new synonym). 1921, *Batrachidea mucronata* Audinet-Serville; Bruner, Ann. Carn. Mus. XIII: 16.

The above synonymy is indicated after a careful study of both the types of *B. notata* (in the U. S. National Museum and studied through the courtesy of Dr. A. B. Gurney), and *T. gracilicornis* (in the Carnegie Museum and studied through the courtesy of Dr. G. Wallace). The type of *B. notata* differs from typical *B. mucronata* in only one respect—its tegminal maculation is much larger than usual. This feature is a variable one and is discussed on a following page. In every other aspect, the type of *B. notata* compares favorably with *B. mucronata* and its name is therefore placed in the synonymy. *Tettigidea gracilicornis* was described from a composite series which included specimens actually belonging to three different genera and species. The lectotype and lectoallotype (selected and designated by the present author, Ann. Carn. Mus. in press) and the paratypes conspecific with them differ in no appreciable quality from typical *B. mucronata* and the name is therefore sunk.

(*Cont. legend from opposite page.*)

B. vesca n. sp.; G, the same of, ♂, type, *B. flavonotata;* H, frontal costa, frontal aspect, ♀, lectoallotype, *B. flavonotata;* I, ninth abdominal sternite, apical portion, ventral aspect, ♂, allotype, *B. macella* n. sp.; J, frontal costa, frontal aspect, ♂, type, *B. vesca* n. sp.; K, the same of, ♀, type, *B. macella* n. sp.; L, the same of, ♀, type, *B. inermis;* M, the same of, ♀, Rio de Janeiro, *B. mucronata.*

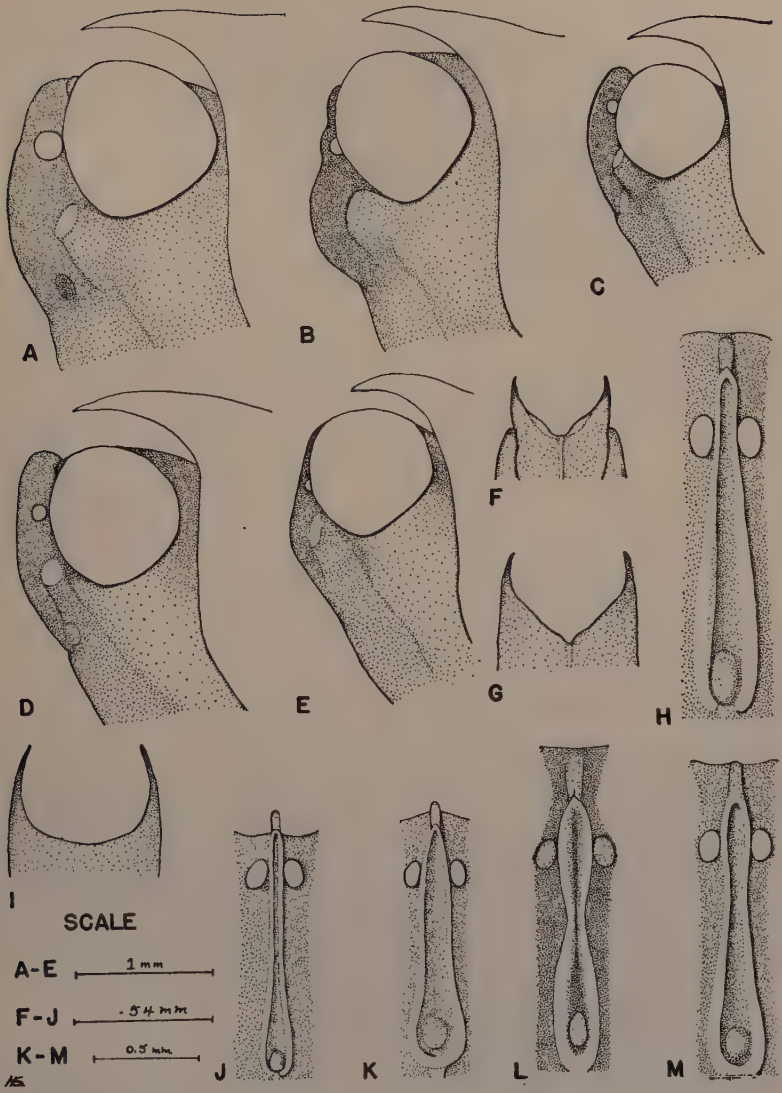


Fig. 1.—Taxonomic characters of the species of *Batrachidea*. A, head, left lateral aspect, ♀, Rio de Janeiro, *B. mucronata;* B, the same of, ♀, type, *B. inermis;* C, the same of, ♂, type, *B. vesca* n. sp.; D, the same of, ♀, type, *B. macella* n. sp.; E, head, left lateral aspect, ♂, type, *B. flavonotata;* F, ninth abdominal sternite, apical portion, ventral aspect, ♂, type,

The type of *B. mucronata* is presumed lost, but since its description several workers have determined with consistency a single taxon to which this name has been applied. Material determined by Morse, Hancock, Hebard, Rehn and Bruner has been examined and only one of these authors (Bruner) was confused over the status of the genus and species. It is evident after a careful study of the bulk of his entire known collection of Tetrigidae (before me *in toto*) that he had little understanding of neotropical tetrigid genera. I cite his misdeterminations because they are the only ones which are known by me to appear in the literature. Because the species was and is well understood, both by previous and present workers, I do not consider it necessary or even desirable to select and describe a neotype.

The type locality is simply stated as "Bresil" by Audinet-Serville and judging from the date of collection (prior to 1792) we may presume that it was coastal Brazil, quite probably near Rio de Janeiro. However, these are assumptions and it is not felt that the restriction of the type locality to any one point in its extensive range (provided in the Régles according to the 1953 Copenhagen Decisions, p. 27) is either a logical or warranted procedure (for a similar viewpoint see Peters, J. A. 1955. Revista Ecuatoriana de Entomologia y Parasitologia II(3-4): 335-336).

For the present work a reasonably large series of over 400 specimens from 37 localities has been studied.

Diagnosis.—*B. mucronata* may be separated at once from *B. flavonotata* and *B. macella* n. sp. by its lack of a tegminal cicatrix. From *B. inermis* it differs in possessing a well-developed spine on the median femora, while from *B. vesca* n. sp. it may be separated because of its much less cristate median pronotal carina and less protrusive frontal costa the dorsal terminus of which is lower than the dorsal surface of the eyes. It is most closely related to *B. flavonotata* and only slightly less so to *B. inermis*. It is much more distantly related to its remaining congeners.

Description; stature and surface.—Size medium for the subfamily, large for the genus; form very robust in females, subrobust in brachypronotal males and subgracile in some macropronotal males; surface variable, coarsely granulose to weakly scabrous.

Head.—Interocular width of vertex equal to about the width of one of the eyes in both sexes. Fastigium truncate, on a line with the anterior border of the eyes; frontal carina obvious on latero-frontal angles only; longitudinal fossulae mesad of eyes moderately narrow and deep. Vertex, in lateral aspect, not quite reaching as high as the dorsal eye surface. Frontal costa protruding before the eyes, approximately low-arcuate in outline; dorsal terminus approximately rectangulate in outline (Fig. 1, A). Frontal costa, in frontal aspect with cristate lateral carinae which in ventral descent are about subparallel between point of divergence and the antennal insertions, thence flaring ectad (Fig. 1, M). Eyes large, protrusive, subtriangulate in outline (subglobose in males). Antennae filiform, 22 segmented.

Pronotum.—Moderately tectate; median carina percurrent, cristate. Anterior termination a fairly stout, slightly decurved spine; posterior apical process truncate to subacuminate. Anterior carinae well marked; from above concave, divergent cauded. In outline, slightly concave in the macropronotal condition, rising anteriorly in the short pronotum forms. Brachypronotal or macropronotal. Tegmina longer than deep, the deepest area closer to the apex; usually with a flavous or brown subapical macula of variable size.

Legs.—Anterior femora sulcate above in proximal half only. Median femora sulcate above throughout; with a well-developed, stout, internal, dorso-apical spine. Posterior femora incrassate, about 3.2 times longer than broad. Posterior tarsus with proximal and distal articles of equal length; the two proximal pulvilli of metatarsus of equal length, the third slightly longer.

Abdomen.—Female subgenital plate truncate. Ninth abdominal sternite of males truncate in medio-apical portion.

Measurements.—(Brachypronotal male and female from Rio de Janeiro. Measurements of the male are given first.) Total body length (face to tip of ovipositor (♀) or abdomen (♂)), 8.8, 12.5 mm; length of pronotum, 7.3, 9.7 mm; depth of pronotum (dorsal surface of median carina to ventral border of lateral lobe), 1.7, 2.7 mm; interocular width of vertex, .60, .73 mm; length of posterior femur, 5.9, 7.7 mm; greatest breadth of posterior femur, 1.8, 2.4 mm.

Variation and discussion.—Over its extensive range *B. mucronata exhibits* limited morphological variation. This is noted chiefly in size, including body stature, degree of stoutness of the pronotal spine, prominence and shape of the frontal pronotal carinae, outline of the frontal costa and size of the tegminal maculation. Table 1 shows the variation in size for four characters from four populations of the present species.

Of the large series (426) studied, 210 (49.5%) are brachypronotal[3] and the remainder macropronotal. An analysis of the four large populations examined (which comprise 79.3% of the total) is presented in the following table (Table 2).

There is an apparent regional correlation with the brachypronotal condition in two populations. The Tingo Maria, Peru series has 74.2% of this type while the Marcapata, Peru series shows only 35.3% of the short pronotum form. The other larger populations studied are closer to the overall average of the entire series. The total known series from Brazil (14 specimens from five localities) are all brachypronotal.

The variation of the tegminal maculation includes specimens in which the macula is nearly obsolete and dull rufous in color, those in which it is conspicuous and bright yellow in color, and all intermediate conditions. The maculae also vary in shape from circular to elongate and from small (the usual case) to rather large (less than 2% of the specimens). There is no geographic correlation with any variant of the tegminal maculation.

In outline, the frontal costa exhibits variation from the typical, evenly arcuate condition (see description and fig. 1, A) to one in which there is a weak emargination at the level of the furcation of the lateral carinae. Other variants show flatter or more arcuate outlines, but all of these conditions are merely individual variations occurring in all populations studied.

The pronotal spine varies slightly in the extent of its decurvation and in its stoutness. The very robust, brachypronotal specimens appear to have the stouter spines while the nearly gracile males have a thin, attenuate and more pronouncedly decurved mucro. Another feature of variation in the pronotum are the frontal carinae which may be concave (the usual condition) or substraight. The degree of prominence of these also is variable and in some specimens they are subobsolete.

The range of this species is virtually coextensive with that of the genus and is shown on the accompanying map (Fig. 2).

---

[3] As used here, brachypronotal is defined as that condition in which the apical process of the pronotum fails to exceed the apices of the posterior femora when these are drawn up on the line of the body's longitudinal axis.

	Tingo Maria, Peru		Palmar, Bolivia		Para, Brazil		Rio de Janeiro, Brazil
Pronotal Length							
macropronotal ♂	9.7	9.8	10.1	9.6			
	10.3	9.6	9.0	9.8			
brachypronotal ♂	8.8	7.9	8.6	6.9	7.2	6.4	7.0
	8.7	7.8	7.6	7.5	6.6	6.3	7.6
macropronotal ♀	14.1	12.6	13.0	12.0			
	13.4	13.1	13.6	12.7			
brachypronotal ♀	10.3	11.9	10.8	10.6	10.9		10.7
	9.4	12.2	11.3	11.0	10.0		
Pronotal Breadth (across humeral angles)							
macropronotal ♂	1.7	1.6	1.6	1.8			
	1.4	1.6	1.7	1.7			
brachypronotal ♂	1.9	1.7	1.8	1.4	1.6	1.4	1.5
	1.6	1.5	1.7	1.6	1.5	1.6	1.7
macropronotal ♀	3.0	2.8	2.9	2.6			
	2.8	2.5	2.9	2.7			
brachypronotal ♀	2.9	2.8	2.8	2.6	2.5		2.7
	2.5	2.7	2.8	2.7	2.6		
Interocular Width							
macropronotal ♂	.56	.50	.55	.47			
	.53	.48	.47	.50			
brachypronotal ♂	.55	.47	.55	.45	.45	.45	.47
	.49	.45	.47	.47	.45	.45	.57
macropronotal ♀	.73	.71	.75	.65			
	.75	.74	.70	.67			
brachypronotal ♀	.75	.71	.72	.70	.75		
	.72	.71	.75	.70	.67		.75
Posterior femur (Length ÷ breadth)							
macropronotal ♂	3.5	3.4	3.4	3.2			
	3.4	3.3	3.3	3.3			
brachypronotal ♂	3.4	3.5	3.5	3.3	3.3	3.0	3.3
	3.6	3.3	3.3	3.3	3.3	3.2	3.1
macropronotal ♀	3.2	3.1	3.3	3.1			
	3.3	3.5	3.0	3.4			
brachypronotal ♀	3.4	3.3	3.3	3.4	3.0		3.1
	3.6	3.4	3.2	3.2			

Table 1.—Size variation in four populations of *Batrachidea mucronata*. All measurements are in millimeters.

Place	Brachypronotal ♂	♀	Total	%	Macropronotal ♂	♀	Total	%	Population total
Peru									
Tingo Maria ..	18	31	49	74.2	12	2	14	25.8	66
Divisoria	6	3	9	40.9	4	9	13	59.1	22
F. do Sinchono	19	39	58	58.0	17	25	42	42.0	100
Marcapata ...	19	23	42	35.3	52	25	77	64.7	119
Bolivia									
Palmar	8	12	20	64.5	5	6	11	35.4	31

Table 2.—Analysis of pronotal dimorphism in five populations of *Batrachidea mucronata*.

Specimens examined (426: 186 ♂, 212 ♀, 28 immature).

COLOMBIA: Villavicencio, Meta, VIII-1917 (A. Maria), 1 ♀ [A.N.S.P.]; La Chorrera to Sombra, Amazonas, 17-31-VIII (Cornell Univ. Exp.), 3 ♀ [A.N.S.P.].

ECUADOR: Puyo, Napo-Pastaza (Rios), XII-1955, 1 ♀, 1 juv. [A.N.S.P.].

PERU: Previsto, 30 mi. S.W. Pucallpa, Loreto, 11-IX-1947 (J. M. Schunke), 1 ♀ [U.S.N.M.]; Pucallpa, Río Ucayali, Loreto, 28-VI-1947 (J. M. Schunke), 1 juv. [A.N.S.P.]; Cerro Azul, 120 mi. N.W. Pucallpa, Loreto, IV-7-1947, 5-V-1947 (J. M. Schunke), 2 ♀ [U.S.N.M. and A.N.S.P.]; Finca do Sinchono, 40 mi. S.W. Pucallpa, Loreto, 31-VII-1947, 2-VIII-1947, 6-VIII-1947, 13-VIII-1947, 24-VIII-1947, 15-VIII-1947, 16-VIII-1947, 18-VIII-1947, 20-VIII-1947, 24-VIII-1947, 25-VIII-1947, 28-VIII-1947, 29-VIII-1947, 3-IX-1947 (J. M. Schunke), 26 ♂, 44 ♀, 8 juv. [U.S.N.M. and A.N.S.P.]; XI-1943 (Sanders), 2 ♀ [U.S.N.M.]; Leonpampa, 110 km. E. of Huanuco, XII-1937 (F. Woytkowski), 6 ♂, 8 ♀ [A.N.S.P.]; Pachitea, Huanuco, 2 ♂, 1 ♀ [A.N.S.P.]; Tingo Maria, Huanuco, XII-1949, 22-I-1950, 4-II-1950, 19-II-1950, II-1950 (H. A. Allard), 26 ♂, 26 ♀, 3 juv. [U.S.N.M. and A.N.S.P.]; 10-X-1954, 2-X-1954, 23-XII-1954 (E. I. Schlinger and E. X. Ross), 3 ♂, 6 ♀ [C.A. and A.N.S.P.]; Shapajilla, Huanuco, 8-IV-1939 (F. Woytkowski), 1 ♂, 2 ♀ [U.S.N.M. and A.N.S.P.]; Huancabamba, Junín (H. Rolle), 1 ♀ [A.N.S.P.]; Puerto Yessup, Junín, II-1930 (M. A. Carriker, Jr.), 3 ♂, 4 ♀, 1 juv. [A.N.S.P.]; El Campamiento, Junín, VI-1920 (Cornell Univ. Exp.), 1 ♂ [A.N.S.P.]; 11°3′ S. lat., 75°17′ W. long., Junín, 8-XI-1906, 14-XI-1906 (N. Iconnicoff), 1 ♂, 2 ♀ [U.N.M.]; Divisoria, 80 mi. S.W. Pucallpa, Junín, 27-VIII-1947, 28-VII-1947, 1-VIII-1947, 18-VIII-1947, 21-VIII-1947, 22-VIII-1947, 27-VIII-1947, 28-VIII-1947 (J. M. Schunke), 10 ♂, 12 ♀, 3 juv. [U.S.N.M. and A.N.S.P.]; Chanchamayo, Junín, 26-IV-1948, 29-IV-1948, 4-V-1948, 6-V-1948, 14-V-1948, 15-V-1948, 28-V-1948, 4-VI-1948, 5-VI-1948, 9-VI-1948, 11-VI-1948 (J. M. Schunke), 9 ♂, 15 ♀, 1 juv. [U.S.N.M. and A.N.S.P.]; La Merced, Junín, 16-XII-1948, 20-I-1949, 23-I-1949, 27-I-1949, 7-II-1949, 10-II-1942 (Schunke), 1 ♂, 5 ♀, 1 juv. [U.S.N.M. and A.N.S.P.]; Iberia, Madre de Dios, IV-30-1950, V-1-1950 (J. C. Pallister), 1 ♀, 1 juv. [A.M.N.H.]; Marcapata, Cuzco, 72 ♂, 49 ♀ [A.N.S.P.].

Bolivia: Cavinas, Beni, I, II-1922 (Mulford Biol. Exp.), 3 ♂ [U.S.N.M.]; Mapiri, La Paz, 5 ♀ [A.N.S.P.]; Palmar, Río San Mateo, Cochabamba, 14-16-IX-1937 (M. A. Carriker, Jr.), 8 ♂, 18 ♀, 9 juv. [A.N.S.P.]; Buena Vista, Santa Cruz (J. Steinback), 1 ♀ [C.M.]; Puerto Suarez, Santa Cruz, XI-1908 to 1-1909, 1 ♂ [C.M.]; Quatro Ojos, Santa Cruz, IX-1917, 1 ♀ [A.N.S.P.]; Las Juntas, Santa Cruz, XII-1913 (Steinbach), 1 ♀ [C.M.]; Río Yapacani, Santa Cruz (J. Steinbach), 1 ♀ [C.M.]; Provincia Sara, Santa Cruz, 20-I to 5-II-1955 (J. Steinbach), 1 ♂, 1 juv. [A.N.S.P.]; Santa Cruz, IX-1917, 1 ♂ [A.N.S.P.]; Yacuiva, Tarija, VIII-1917, 1 ♀ [A.N.S.P.]; Bolivia, X, XI, XII-1949, 4 ♂, 3 ♀ [collection of Willemse]; 5 ♀ [A.N.S.P.].

Brazil: Pará, IX, 6 ♂, 1 ♀, 1 juv. [C.M. and A.N.S.P.] (lectotype and paratypes of *Tettigidea gracilicornis* Bruner); Chapada, Matto Grosso, VIII, 1 ♀ [C.M.] (lectoallotype of *Tettigidea gracilicornis* Bruner); Bello Horizonte, Minas Geraes, IV-1935 (D. M. Cochran), 1 ♀ [U.S.N.M.]; 20 km. NE. Rio de Janeiro, Barro Branco, 30-XI to 1-XII-1940 (J. R. Bailey), 1 ♂, 1 ♀ [U.M.Z.]; Rio de Janeiro, IX, 1 ♂ [C.M.] (paratype of *Tettigidea gracilicornis* Bruner); Monat, IV-1935 (P. Sandig), 1 ♂ [U.S.N.M.].

Batrachidea flavonotata Bolívar Plate XV, figs. 3, 4.

1887, *Batrachidea flavo-notata* Bolívar, Amn. Soc. Ent. Belg. xxxi: 300.
1923, *Batrachidea flavo-notata* Bolívar; Hebard, Trans. Amer. Ent. Soc. 49: 176.

This species remains known from only the three previously recorded specimens. Through the courtesies of the authorities of the Swedish Museum, Stockholm, I have been able to examine the types, and here designate as lectotype the male from New Granada recorded by Bolívar in the original description. The female bearing the same data is designated lectoallotype. Both specimens are figured and redescribed below.

Diagnosis.—*B. flavonotata* may be distinguished from other taxa of the genus by the following character combination. The possession of a large, subapical, flavous, tegminal cicatrix and greatly reduced character of the internal, dorso-apical spine of the median femora separates it from *B. macella* n. sp., the only other species possessing a tegminal cicatrix of this type but which has a well-developed spine on the median femora. From *B. inermis* it may be separated by its possession of a tegminal cicatrix (lacking in that species).

Description.—(Lectotype, ♂.) Stature and surface. Size medium for the genus; form robust; surface coarsely granulose, the granules widely scattered.

Head.—Interocular width of vertex equal to the width of one of the eyes; fastigium, from above, truncate, not reaching the anterior border of the eyes; anterior carinae, in same aspect, reduced to two small, lateral projections; longitudinal fossulae mesad of eyes very narrow, deep. Vertex, as seen laterally, lower than dorsal surface of eyes. Frontal costa, in lateral aspect, protruding before the eyes; dorsal terminus obtuse-angulate rounded, not reaching the dorsal surface of the eyes; lateral outline as in fig. 1, E. Face moderately retreating in outline. Vertex, in frontal aspect, lower than the dorsal surface of the eyes; median area somewhat convexed; latero-frontal carinulae sloping obliquely dorso-ectad. Frontal costa, in frontal aspect, with cristate, evenly and narrowly diverging lateral carinae; sulcus very narrow, somewhat shallow. Antennae filiform; elongate, about one and one-half times the dorso-ventral length of the head; 21 segmented.

Pronotum.—Moderately tectate; median carina percurrent, cristate, rising, in lateral outline, over the head; terminating anteriorly in a very weakly decurved, spinous process which reaches only half way across the vertex, posteriorly terminating in a narrowly truncate apical process. Anterior carinae subobsolete, parallel. Brachypronotal, falling short of the apices of the posterior femora by one-quarter the length of one of them. Tegmina prominent, deep, with a large, subapical, flavous cicatrix.

Legs.—Anterior femora with an obsolete sulcation above; very weakly inflated. Median femora shallowly sulcate above for entire lengths; with a weak, internal, dorso-apical spine. Posterior femora subgracile, about 3.6 times longer than broad; distal element of posterior tarsus slightly longer than proximal two elements combined.

Abdomen.—Apex of ninth abdominal sternite as in fig. 1, G.

Coloration.—Pronotum (except for apical process), vertex and posterior limbs, dark brown. Face, genae, tip of pronotum, light cream.

Measurements.—Total body length (face to tip of abdomen), 7.4 mm; length of pronotum, 6.8 mm; depth of pronotum (dorsal surface of median carina to ventral border of lateral lobe), 1.6 mm; interocular width of vertex, .5 mm; length of posterior femur, 5.0 mm; greatest breadth of posterior femur, 1.4 mm.

Description.—(Lectoallotype, ♀.) Stature and surface: size medium; form robust; surface more coarsely granulose than in male.

Head.—Interocular width of vertex 1.3 times the width of one of the eyes; fastigium from above, truncate, on a line with the anterior margins of the eyes. Supra-ocular lobes small; longitudinal fossulae mesad of eyes deep, prominent. Anterior carina of fastigium reduced to lateral ridges; dorsal surface of vertex beneath that of eyes. In lateral aspect, frontal costa weakly protrusive, form as in male. Face more strongly retreating in outline. Eyes subtriangular in outline. Vertex, when seen frontally, flatter than in male; latero-frontal carinulae of fastigium concave. Lateral carinae of frontal costa cristate, subparallel in ventral descent; sulcus narrow, rather deep (Fig. 1, H). Antennae missing in type.

Pronotum.—More highly tectate than in male; median carina percurrent, more strongly cristate. Lateral outline weakly undulate, almost plane. Anterior spinous process more advanced than in male, almost reaching fastigium. Anterior carinae subobsolete; diverging posteriorly. Brachypronotal. Tegmina as in male.

Legs.—Anterior femora with a subobsolete sulcation above, noticeable in proximal three-quarters of their lengths. Median femora strongly sulcate above for entire lengths; with a subobsolete, dorso-apical, internal spine. Posterior legs missing.

Coloration as in male.

Measurements.—Total body length (face to tip of ovipositor), 11.4 mm; length of pronotum, 9.7 mm; depth of pronotum (dorsal surface of median carina to ventral border of lateral lobe), 2.8 mm; interocular width of vertex, .8 mm; (posterior femora missing).

The Santander locality recorded by Hebard (see above) is shown on the following map (Fig. 2).

Batrachidea inermis Hebard Plate XV, fig. 5.

1923, *Batrachidea inermis* Hebard, Trans. Amer. Ent. Soc. 49: 174-175.

This species was fully described by Hebard and the typical material has been reexamined. The only criticism to Hebard's description pertains to the figure of the type showing the vertex from above (plate XI, fig. 3) which is erroneous. This figure shows the fastigium advanced before the eyes, a condition not found in the type or other material of the species. The sinuate apical margin of the female subgenital plate mentioned by Hebard is only slightly evident, this structure being essentially truncate.

B. inermis is readily differentiated from the other members of the genus it superficially resembles (*B. flavonotata* and *B. mucronata*) by its unarmed median femora. From its remaining congeners, it may be separated by its larger size and facial profile which protrudes before the eyes at the fastigio-facial angle in all except this species (Fig. 1, B, L).

In addition to the typical material (Andagoya, Colombia), one specimen has been examined.

COLOMBIA: 50 km. w. of Cali, Valle del Cauca, 30-VIII-1954 (E. S. Ross), 1 ♀ [C.A.].

This additional specimen is brachypronotal. In coloration it is somewhat darker than the type, being an overall dull, blackish brown. The antennae are 22 segmented.

Measurements.—Total body length (face to tip of ovipositor), 12.0 mm; length of pronotum, 11.3 mm; depth of pronotum (dorsal surface of median carina to ventral tip of lateral lobe), 3.2 mm; interocular width of vertex, 1.0 mm; length of posterior femur, 7.8 mm; greatest breadth of posterior femur, 2.4 mm.

The known distribution of the species is shown on the following map (Fig. 2).

Batrachidea macella n. sp. Plate XV, fig. 6.

Diagnosis.—The present species is easily distinguished from others in the genus by its more slender form, proportionately smaller eyes and by the protrusive frontal costa which has its dorsal terminus higher than the eyes in females. This last character will serve to separate the species from those other members of the genus which possess large, flavous cicatrices near the tegminal apices, but which lack a protrusive frontal costa, the dorsal terminus of which it on a level with, or but slightly higher than, the dorsal border of the eyes. The other species of the genus possessing a frontal costa of this type (*B. vesca* n. sp.) is smaller and lacks the tegminal cicatrix. *B. macella* is most closely related to *B. vesca* n. sp. These two species are more distantly related to the other known forms included in the genus.

Type. ♀, Chapada, Matto Grosso, Brazil, VII [C.M.]. (Recorded by Bruner, 1910, as *Batrachidea notata* Hanc.)

Description; stature and surface.—Size medium for the genus; form subgracile; surface coarsely granulate, moderately scabrous with occasional larger tubercles.

Head.—Interocular width of vertex 1.1 times the width of one of the eyes; fastigium, from above, truncate, slightly advanced before the eyes, its anterior carina reduced to latero-frontal carinulae which are prominent and convexed; fossulae mesad of eyes broad and deep; supra-ocular lobes prominent, large. Dorsal terminus of frontal costa, from above, cristate, proceeding posteriorly a very short distance on the vertex. Vertex, in lateral aspect, lower than the dorsal surface of the eyes. Frontal costa, in lateral aspect, protrusive, advanced before the eyes a distance equal to one-third the width of one of them in lateral aspect; low arcuate in outline; dorsal terminus slightly higher than the dorsal surface of the eyes (Fig. 1, D). Face retreating very slightly in profile. Eyes subtriangulate in

lateral outline. Vertex, in frontal aspect, lower than the dorsal surface of the eyes; raised (convexed) in median area, ectad of this shallowly concave on either side. Latero-frontal carinulae of fastigium, in frontal aspect, visible as two concave carinae extending mesad toward the frontal costa. Lateral carinae of frontal costa cristate; sharply diverging above paired ocelli, thence dropping, subparallel, ventrad to median ocellus where they diverge slightly; median sulcus deep (Fig. 1, K). Antennae of medium length, about 1.2 times longer than the dorso-ventral depth of the head; filiform, 21 segmented.

Pronotum.—Moderately tectate; median carina strongly cristate, percurrent. In lateral outline rising anteriorly above the head; terminating anteriorly, in a rather fine decurved, spinous process; terminating posteriorly, in a bluntly rounded apical process. Anterior carinae strong, blunt, beaded; when seen from above, weakly concave, posteriorly convergent. Scapular area elongate, moderately deep, dorsally arched. Macropronotal, the pronotum exceeding the knees by about one-quarter the length of a posterior femur. Lateral lobes with acutely angulate superior sinuses; inferior sinus obtusely angulate, posterior border beneath this oblique, its ventral end directed slightly caudad. Tegmina of moderate size, rather elongate, almost reaching the end of the scapular area; with a large, subapical cicatrix. Lateral lobes, from above, distinctly splayed, distance between their caudo-ventral angles equal to slightly less than one-third the length of the pronotum.

Legs.—Anterior femora slightly inflated; weakly sulcate above in proximal half only. Median femora more strongly sulcate above for entire lengths; with a subobsolete, internal, dorso-apical spine. Posterior femora moderately incrassate, about three times longer than broad; paginae with a few low, oblique ridges; distal element of posterior tarsus equal in length to metatarsus.

Coloration.—Whole body a somber fuscous, mottled with black.

Measurements.—Total body length (face to tip of ovipositor) 9.8 mm; length of pronotum, 11.4 mm; depth of pronotum (dorsal surface of median carina to ventral border of lateral lobe), 2.4 mm; interocular width of vertex, .7 mm; length of posterior femur, 6.5 mm; greatest breadth of posterior femur, 2.1 mm.

Allotype. ♂, Corumbá, Matto Grosso, Brazil, III [C.M.]. (Recorded by Bruner, 1910, as a paratype of *Tettigidea gracilicornis.*)

The allotype differs from the female type in the following characters.

Surface.—Smoother, non-scabrous.

Head.—Interocular width of vertex slightly less than the width of an eye. Fastigium, from above, not reaching the anterior border of the eyes; fossulae mesad of eyes shallow; vertex, in frontal aspect, flatter, not domed.

Frontal costa, in lateral aspect, advanced before the eyes only slightly; anteriorly flattened in outline; dorsal terminus lower than the dorsal surface of the eyes. Fastigium not visible in lateral aspect. Eyes globose in lateral aspect. Lateral carinae of frontal costa evenly diverging in ventral descent.

Pronotum.—More lowly tectate; terminating posteriorly in a subacute apical process. Anterior carinae not beaded. Brachypronotal, the pronotum terminating before the knees a distance equal to one-quarter the length of a posterior femur.

Coloration.—Whole body a light brown, mottled with fuscous.

Abdomen.—Ninth abdominal sternite with apex as in fig. 1, I.

Measurements.—Total body length (face to tip of abdomen), 8.1 mm; length of pronotum, 6.7 mm; depth of pronotum (dorsal surface of median carina to ventral border of lateral lobe), 1.7 mm; interocular width of vertex, .5 mm; length of posterior femur, 5.0 mm; greatest breadth of posterior femur, 1.6 mm.

Paratypes. (4; 3 ♀, 1 ♂)

Bolivia: Cuatro Ojos, Santa Cruz, XI-1917 (Lizer-Deletang), 1 ♀ [A.N.S.P.]; Villa Montes, Tarija, XI-1917 (Lizer-Deletang), 1 ♀ [A.N.S.P.].

Brazil: Corumbá, Matto Grosso, IV, 1 ♂ [C.M.]. (This specimen recorded by Bruner, 1910, as *Batrachidea flavonotata.*)

Paraguay: Concepcion, XII, 1 ♀ [C.M.]. (This specimen recorded by Bruner, 1910, as *Batrachidea notata.*)

Variation and discussion.—The present small series exhibits little basic variation over its rather limited range. In both sexes the outline of the frontal costa varies from being slightly flattened anteriorly to being perfectly low arcuate. Both macropronotal and brachypronotal individuals occur. The pronotal outline varies from almost straight on the dorsal surface to the condition of the type in which the anterior quarter rises sharply over the head and shoulders.

The distribution of this species in shown on the accompanying map (Fig. 2).

Batrachidea vesca n. sp. Plate XV, fig. 2.

Diagnosis.—This minute species may be separated from others in the genus because of its very small size, extremely cristate median pronotal carina and distinctive frontal costa whose dorsal terminus rises well above the dorsal surface of the eyes. In this latter respect it most closely approaches *B. macella* n. sp., but differs from that species in possessing a small, flavous, subapical,

tegminal macula instead of a large cicatrix on the same organ and in having the ninth abdominal sternite in males apically emarginate instead of entire.

Type. ♂, Cuatro Ojos, Santa Cruz, Bolivia, XI-1917 (Lizer-Deletang). [Acad. Nat. Sci. Phila. Type no. 5897.]

Description; stature and surface.—Size very small for the genus; form subgracile; surface rather finely granulose, with two very smooth, shiny, black surface bosses near the dorsal border of the pronotal lateral lobes.

Head.—Interocular width of vertex equal to .8 the width of one of the eyes. Fastigium, from above, truncate, not reaching the anterior border of the eyes; anterior carina obsolete, present on ectal borders only; dorsal terminus of frontal costa proceeding posteriorly for a short distance on the vertex; longitudinal fossulae mesad of eyes obsolete; supra-ocular lobes small, prominent. Vertex, in lateral aspect, well below the dorsal border of the eyes. Frontal costa, in lateral aspect, very protrusive, advanced before the eyes a distance equal to one-third the width of one of them in lateral aspect, evenly arcuate (Fig. 1, C). Face moderately retreating in profile. Eyes globose in lateral aspect. Vertex, in frontal aspect, lower than the dorsal surface of the eyes; ectal carinulae of fastigium oblique, rising to almost touch the dorsal border of the eyes. Lateral carinae of frontal costa cristate; parallel in ventral descent for entire length except for slight flare around median ocellus; carinae very close set, sulcus between extremely narrow and shallow (Fig. 1, J). Face, in frontal aspect, rather long and narrow. Antennae missing in type.

Pronotum.—Moderately tectate; median carina acutely cristate, percurrent. In lateral outline, dorsal surface rising posteriorly; terminating anteriorly in a decurved, spinous process which reaches as far anteriorly as the fastigium; posterior termination subacute. Anterior carinae smooth, clearly defined, when seen from above subparallel. Scapular area narrow, relatively short, weakly arched dorsally. Brachypronotal, the pronotum terminating anterior to the knees a distance equal to slightly less than one-sixth the length of a posterior femur. Lateral lobes with superior sinus approximately rectangulate; inferior sinus obtusely angulate; posterior border beneath this directed caudo-ventrad. Tegmina lobulate; with a small, subapical, flavous maculation. Lateral lobes, from above, moderately splayed, distance between their caudo-ventral angles equal to a little less than one-third the length of the pronotum.

Legs.—Anterior femora weakly sulcate above for entire lengths. Median femora strongly sulcate above for entire lengths; with a very small, sharp, internal, dorso-apical spine. Posterior femora moderately incrassate, about three times longer than broad; distal tarsal element equal in length to the length of the proximal two articles combined; all pulvilli of posterior metatarsus equal in length; paginae roughened.

Abdomen.—Medio-apical portion of ninth abdominal sternite as figured (Fig. 1, F).

Coloration.—Pronotum, head, anterior and median femora, anterior third of posterior femur light tan mottled with fuscous. Cristate median pronotal carina with alternate light tan and darker fuscous areas. Posterior two-thirds of posterior femora fuscous-black.

Measurements.—Total body length (face to tip of abdomen), 6.6 mm; length of pronotum, 6.7 mm; depth of pronotum (dorsal surface of median carina to ventral border of lateral lobe), 1.8 mm; interocular width of vertex, .4 mm; length of posterior femur, 4.5 mm; greatest breadth of posterior femur, 1.5 mm.

The type is unique.

The type locality is indicated on the following map (Fig. 2).

PUIGGARIA Bolívar

1887, *Puiggaria* Bolívar, Ann. Soc. Ent. Belg. xxxi: 302-303. 1906, *Puiggaria* Bolívar; Hancock, Gen. Insectorum, Fasc. 48: 71-72. 1910, *Puiggaria* Bolívar; Bruner, Ann. Carn. Mus. vii: 143.

Genotype (monotypy) *Puiggaria antennata* Bolívar.

This genus has been reported only once since its description by Bolívar in 1887 when Bruner misidentified it in his 1910 paper (as *Batrachidea mucronata* ?). Since the original description is somewhat lacking in details, the genus is redescribed and figured below. I am indebted to Dr. Morales Agacino of the National Museum, Madrid, for comparing sketches of my material with Bolívar's type.

Diagnosis.—*Puiggaria* is unique among batrachideine genera in possessing a frontal costa, the lateral carinae of which are very widely divergent, forming a scutellate frontal depression (Fig. 3, B). It also differs in having a very broad vertex and protrusive eyes which are proportionately smaller than those found in other genera in the subfamily.

This genus is apparently only remotely related to others in the subfamily. In some features such as general stature, form of the median and posterior femora, it resembles *Batrachidea*, but the structures mentioned above readily differentiate it from this genus.

Generic characters.—Form moderately robust; surface generally smooth with numerous small tubercles on pronotal surface. Vertex broad; fastigium

Fig. 2.—Map showing the distribution of *Batrachidea*. Open circles, *B. macella* n. sp.; filled circles, *B. mucronata*; circles with lower half filled, *B. inermis*; circle with upper half filled, *B. vesca* n. sp.; circle with cross, *B. flavonotata*.

not reaching anterior border of eyes, its frontal carina absent in median third. Frontal costa prominent, in lateral aspect well advanced before the eyes, with widely furcate lateral carinae. Face subvertical in outline. Eyes small, globose, very protrusive. Pronotum tectate, anteriorly uncinate; median carina strongly cristate; in outline straight or slightly undulate. Female subgenital plate with medio-apical protrusion (Fig. 3, C).

Puiggaria antennata Bolívar Plate XVI, figs. 7, 8.

1887, *Puiggaria antennata* Bolívar, Ann. Soc. Ent. Belg. xxxi: 302-303. 1906, *Puiggaria antennata* Bolívar; Hancock, Gen. Insectorum, fasc. 48: 72. 1910, *Batrachidea mucronata* Audinet-Serville; Bruner, Ann. Carn. Mus. vii: 141 [misdetermination].

With the Bruner series before me, I am able to refer all specimens mentioned by that author as possibly belonging to this species, but identified by him as *Batrachidea mucronata,* to this taxon. The following description includes those details not mentioned in the generic description.

Description; Head.—Interocular width of vertex about 2.6 times the width of one of the eyes in both sexes; with large shallow fossae mesad of eyes; supra-ocular lobes small but prominent; median carina absent. Frontal carina of fastigium, from above, appearing slightly cristate and lowly arcuate. Vertex, in lateral aspect, on same plane as dorsal surface of eyes. Frontal costa, in lateral aspect, advanced before the eyes, lowly arched with highest point between the antennal bases (Fig. 3, A). In frontal aspect, lateral carinae of frontal costa cristate, widely furcate, sulcate between (Fig. 3, C). Antennae with variable number of articles, (20-22), elongate, about one and one-half times longer than the dorso-ventral length of the head. Ocelli very small.

Pronotum.—Anterior uncination decurved, reaching the fastigium or slightly beyond. Anterior carinae prominent, concave when seen from above. Lateral lobes, from above, moderately flared. Tegmina elongate, slightly flattened on ventro-caudal border.

Legs.—Anterior femora with conspicuous sulcation above. Median femora with stronger sulcation above, slightly dilated at distal end, with a well-developed dorso-apical spine. Posterior femora sub-gracile in form, about 3.2 times longer than broad; first and third tarsal articles subequal in length.

Measurements.—(♀, Chapada, Brazil.) Total body length (face to tip of ovipositor), 9.8 mm; length of pronotum, 11.3 mm; depth of pronotum (dorsal surface of median carina to ventral tip of lateral lobe), 2.4 mm; length of posterior femur, 5.5 mm; greatest breadth of posterior femur, 1.7 mm.

Inasmuch as the male has been previously unreported, the description of the allotype follows.

Allotype. ♂, Nova Teutonia, Correio Ita, Santa Catharina, Brazil, 2-X-1935 (Fritz Plaumann). [Acad. Nat. Sci. Phila.]

Stature and surface.—Size smaller than females; form similar; surface somewhat smoother.

Head.—Vertex with same interocular/eye-width proportion as in females. In lateral aspect, dorsal surface of vertex slightly lower than that of the eyes; frontal costa advanced before the eyes, but proportionately less so than in females; facial outline more declivent. Eyes slightly more protrusive than in females.

Pronotum.—Median carina more highly cristate; in outline slightly elevated anteriorly. Brachypronotal. Tegmina slightly less elongate; evenly rounded on postero-caudal border.

Abdomen.—Ninth sternite medio-apically emarginate (Fig. 3, D).

Measurements.—Total body length (face to tip of abdomen), 8.5 mm; length of pronotum, 6.6 mm; depth of pronotum (dorsal surface of median carina to ventral tip of lateral lobe), 2 mm; length of posterior femur, 4.6 mm; greatest breadth of posterior femur, 1.4 mm.

Variation and discussion.—The present small series of this species varies in the following characters. The pronotal form may be either brachypronotal or macropronotal and one of the specimens (♀, Santa Catharina, Brazil) is intermediate having the pronotum slightly exceeding the knees. The dorsal surface of the pronotum is plane in most of the specimens, but is undulate in the Santa Catharina female. The uncinate process of the pronotum is slightly elevated in some specimens.

The distribution of this species is known in Southern Brazil only from the States of Matto Grosso, Paraná and Santa Catharina.

Specimens examined (7; 5 ♀, 2 ♂).

Brazil: Chapada, Matto Grosso, VIII and X, 4 ♀, 1 ♂ [C.M., U.N.M., A.N.S.P.]; Nova Teutonia (Correio Ita), Santa Catharina, 2-X-1935 (Fritz Plaumann), 1 ♀, 1 ♂ (**allotype**), [A.N.S.P.].

LOPHOSCIRTUS Bruner

1910, *Lophoscirtus* Bruner, Ann. Carn. Mus. VII: 138-139.

Genotype (monotypy) *Tettigidea gracilis* Bruner.

This monotypic genus is known from only four specimens including the type which has been examined through the courtesy of Dr. Larry Quate of the University of Nebraska. The species was first described by Bruner as a member of the genus *Tettigidea,* but was later recognized by him as being generically distinct. His descriptions are adequate in most respects and only a summary of the characters not previously mentioned are given below.

Diagnosis.—*Lophoscirtus* differs from all other known neotropical batrachideines in possessing a protrusive frontal costa

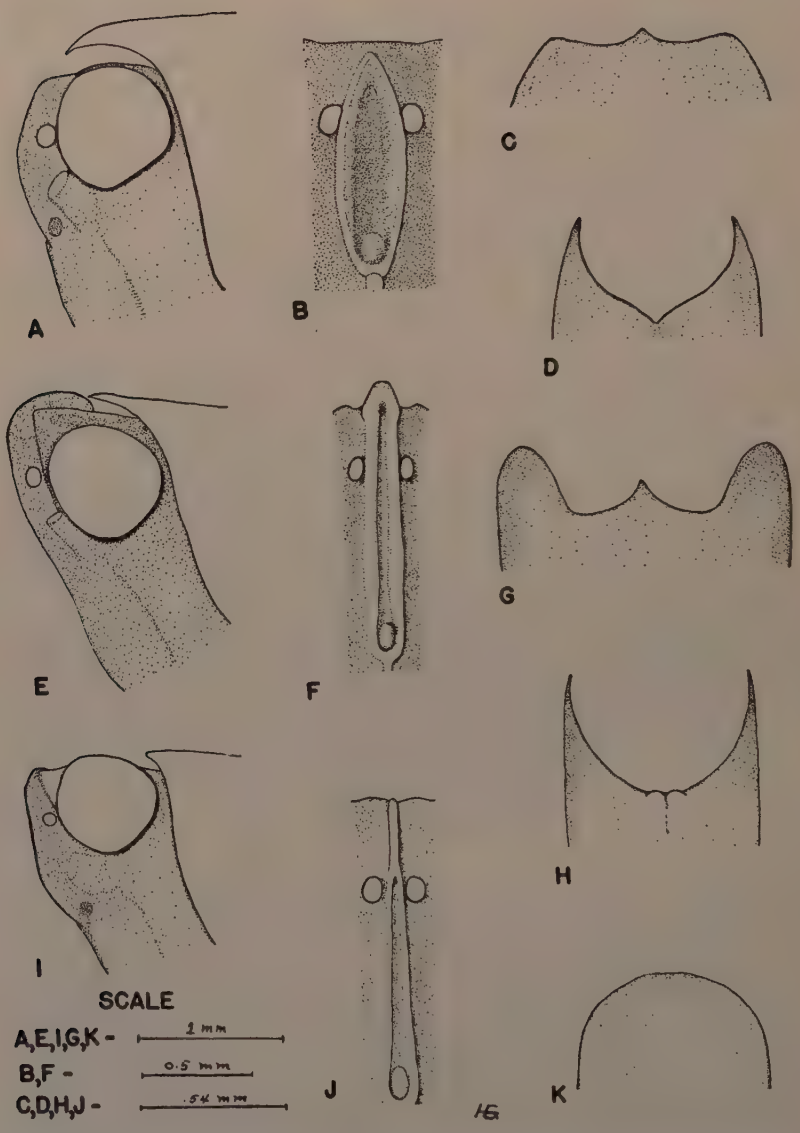


Fig. 3.—Taxonomic characters of *Puiggaria, Lophoscirtus* and *Eutettigidea. Puiggaria antennata:* A, head, left lateral aspect, ♀, Chapada; B, frontal costa, frontal aspect, ♀, Chapada; C, subgenital plate, apical portion, ventral aspect, ♀, Chapada; D, ninth abdominal sternite, apical

the lateral carinae of which begin to diverge above the level of the dorsal surface of the eyes (Fig. 3, F) and which is dorsally semicircular in outline (see fig. 3, E). It may also be recognized by its very short antennae which are slightly shorter than the dorso-ventral length of the head and possess only 17 segments.

The genus is not very closely related to any others in the subfamily with the sole exception of *Tettigidea* from which it may have been derived or with which it may share a common ancestry. Several species of *Tettigidea* show a tendency toward the development of a frontal costa such as that found in *Lophoscirtus* (among them *T. cuspidata* Scudder, *T. spicatoides* Hebard, *T. nicaraguae* Bruner, etc.). Others exhibit a similarity in the form of the female subgenital plate (*T. hancocki* Bruner) and in the longitudinally rugulate pronotum (*T. corrugata* Bruner, *T. hancocki* Bruner, *T. spicatoides* Hebard, etc.). However, the two are easily separated by a meristic character (antennal segment number), the form of the female subgenital plate (see fig. 3, G) and by the more slender body form of *Lophoscirtus* whose posterior femora are more attenuate than any found in the genus *Tettigidea.*

Lophoscirtus gracilis Bruner Plate XV, fig. 7.

1900, *Tettigidea gracilis* Bruner, Second Report Merchants Invest. Comm. Buenos Aires, p. 17. 1906, *Tettigidea gracilis* Bruner, Proc. U. S. Nat. Mus. xxx: 616. 1906, *Tettigidea gracilis* Bruner; Hancock, Gen. Insectorum, fasc. 48: 68. 1910, *Lophoscirtus gracilis* Bruner, Ann. Carn. Mus. vii: 138-139.

Specific characters.—Size small for the subfamily; form gracile; surface granulose. Interocular width of vertex 2.5 times the width of one of the eyes. Fastigium advanced before the eyes; with a well-developed frontal carina which is medially interrupted by the frontal costa. Face, in frontal aspect, rather narrow, about twice as long (dorso-ventrally) as broad. Pronotum moderately tectate; macropronotal; anterior carinae parallel; median

---

(*Cont. legend from opposite page.*)
portion, ventral aspect, ♂, allotype. *Lophoscirtus gracilis:* E, head, left lateral aspect, ♀, type; F, frontal costa, frontal aspect, ♀, type; G, subgenital plate, apical portion, ventral aspect, ♀, type; H, ninth abdominal sternite, apical portion, ventral aspect, ♂, allotype. *Eutettigidea lineata:* I, head, left lateral aspect, ♀, paratype; J, frontal costa, frontal aspect, ♀, paratype; K, subgenital plate, apical portion, ventral aspect, ♀, paratype.

carina percurrent, subcristate; dorsal surface with several distinctive, longitudinal rugulae. Anterior femora sulcate above in proximal half, the mesal carina higher than the ectal one. Median femora with an obsolete dorsoapical, internal spine. Posterior femora elongate, about 3.7 times longer than broad; pulvilli of tarsus increasing regularly in size in proximal to distal sequence. Female subgenital plate as figured (Fig. 3, G); male ninth abdominal sternite weakly emarginate (Fig. 3, H).

Measurements (of type).—Total body length (face to tip of ovipositor), 10.9 mm; length of pronotum, 13.3 mm; depth of pronotum (dorsal surface of median carina to ventral border of lateral lobe), 2.5 mm; interocular width of vertex, 0.9 mm; length of posterior femur, 5.5 mm; greatest breadth of posterior femur, 1.5 mm.

The type is in the collection of the University of Nebraska Museum.

Since the male has been previously unknown the description of the allotype follows.

Allotype. ♂, Montevideo, Uruguay, Exp. de la Bonite Gaudichaud, 1837. [Paris Museum.]

The allotypic male differs from females chiefly in the following details.

Size smaller. Frontal costa less protrusive, slightly emarginate in outline. Face, in outline, retreating more sharply. Eyes more protrusive, proportionately slightly larger. Median carina of pronotum more cristate; longitudinal rugulae less regular in form. Ninth abdominal sternite as figured (Fig. 3, H).

Measurements.—Total body length (face to tip of abdomen), 9.7 mm; length of pronotum, 11.2 mm; depth of pronotum (dorsal surface of median carina to ventral border of lateral lobe), 1.6 mm; interocular width of vertex, .66 mm; length of posterior femur, 4.6 mm; greatest breadth of posterior femur, 1.2 mm.

Specimens examined (4; 3 ♀, 1 ♂).

ARGENTINA: Corrientes, 1 ♀ (type), [U.N.M.].

URUGUAY: Montevideo, 1837, 2 ♀, 1 ♂ (allotype), [P.M. and A.N.S.P.].

Variation and discussion.—The small series available for study shows no appreciable variation in any of its more important characters. In coloration, the Uruguayan specimens appear much lighter and their surfaces are more finely granulate. In distribution, the genus is known only from the Paraná and La Plata drainages and may represent an element of the little known tetrigid fauna of temperate South America.

EUTETTIGIDEA Hancock

1910, *Lophotettix* Bruner, Ann. Carn. Mus. VII: 137 (name preoccupied). 1914, *Eutettigidea* Hancock, Ent. News XXV: 328. *Lophotettix* Bruner; Grant, Ann. Carn. Mus. (in press). [Designation of lectotype.]

Genotype (monotypy) *Lophotettix lineatus* Bruner.

The present genus remains known only from the original series of four specimens which are now before me. Since Bruner's description omits several important characters and fails to figure the type these details are supplied below.

Diagnosis.—Eutettigidea may be recognized as one of the smaller batrachideines which lacks the anterior pronotal spine so characteristic of this group. As pointed out by Bruner, the superficial resemblance to *Tetrix* is evident, especially in the lateral aspect of the frontal costa. It is, however, a true batrachideine by virtue of its possession of sulcate median femora, and by the shape of the female subgenital plate which is of a type not found in any species of *Tetrix*. It is most closely related to *Tettigidea*, but differs from that genus in the form of its frontal costa, more slender stature, proportionately smaller eyes and depressed vertex. The taxon could only be confused with *Rehnidium* n. g., but the resemblance here is superficial and the two can be separated by a comparison of their frontal costae which is less protrusive in this form and by the presence of the pronotal spine in *Rehnidium*.

Generic characters.—Size very small for the subfamily; form gracile; surface finely granulose. Fastigium advanced before the eyes; vertex relatively narrow, depressed below the dorsal surface of the eyes. Frontal costa with cristate, closely appressed lateral carinae. Eyes little protrusive; small. Pronotum very lowly tectate; anteriorly angulate, but not spinous; dorsal surface with several prominent, longitudinal rugulae. Posterior femora robust. Female subgenital plate evenly produced apically in ventral aspect.

Eutettigidea lineata (Bruner) Plate XV, fig. 8.

1910, *Lophotettix lineatus* Bruner, Ann. Carn. Mus. VII: 137-138. *Eutettigidea lineata* (Bruner); Hancock, Ent. News XXV: 328. *Lophotettix lineatus* Bruner; Grant, Ann. Carn. Mus. (in press). [Designation of lectotype.]

In addition to the characters mentioned above, the following are recorded.

Specific characters; Head.—Interocular width of vertex equal to 1.4 times the width of one of the eyes. Fossae mesad of eyes very shallow; supraocular lobes small. Fastigium, from above, arcuate in outline, interrupted medially by the frontal costa; advanced before the eyes a distance equal to about one-third the width of one of them; frontal carina strong, interrupted by dorsal terminus of frontal costa. Face, in profile, slightly sinuous; retreating. Frontal costa, in lateral aspect, protrusive; slightly emarginate at the level of the paired ocelli (Fig. 3, I, J). Vertex slightly lower than the dorsal surface of the eyes.

Pronotum.—Low tectate. In outline very slightly concave. Anteriorly obtuse angulate. With a median, percurrent, subcristate carina. Dorsal surface longitudinally rugulose; anterior carinae prominent, parallel. Tegmina evenly arched below, about three times longer than deep, apically maculate or immaculate.

Legs.—Anterior femora completely lacking usual sulcation above. Median femora sulcate above for entire lengths; lacking the usual internal, dorsoapical spine. Posterior femora moderately incrassate, about 3.3 times longer than broad; first and third tarsal articles equal in length; pulvilli of metatarsus increasing in size regularly in proximal to distal sequence.

Abdomen.—Subgenital plate of female as figured (Fig. 3, K). Ovipositor valves short and broad.

Measurements (of type).—Total body length (face to tip of ovipositor), 6.8 mm; length of pronotum, 8.3 mm; depth of pronotum (dorsal surface of median carina to ventral tip of lateral lobe), 1.8 mm; length of posterior femur, 5 mm; greatest breadth of posterior femur, 1.6 mm.

Variation and discussion.—The type series exhibits variation in pronotal length as follows: 8.3, 9.2, 10.0 mm. In color the type is a light sandy brown, but the three paratypes are a darker fuscous with occasional spots of the lighter sandy color. The tegmina of one paratype have small, apical, flavous maculae. The species is known from females only.

Specimens examined. (Type and paratypes.)
Chapada, Matto Grosso, Brazil, 4 ♀ [C.M., U.N.M., A.N.S.P.].

REHNIDIUM n. g.

Diagnosis.—The genus is distinguished on the basis of its very small size, protrusive frontal costa, proportionately large, globose and protrusive eyes, the shape of the female subgenital plate (Fig. 4, H) and the short, broad ovipositor valves. Its relationship to other batrachideine genera is obscure, but it seems more closely related to *Scaria* and *Batrachidea* than any others, showing slightly greater affinity with the first of these. The form of

the female subgenital plate readily serves to separate it from the first of these two. Since its size, general facies, and the shape of the female subgenital plate resembles that of *Eutettigidea* it might be confused with this genus. It can be at once separated, however, by its possession of a well-developed anterior pronotal spine (lacking in *Eutettigidea*), in the different form of its frontal costa and much more protrusive eyes.

In distribution, the genus is known only from the Orinoco-Amazonian basin and the eastern slopes of the Andes. In the northeastern part of its range it is found in Venezuela (Barinas) and Dutch Guiana (Paramaribo), while to the south it is recorded only from central and western South America in Brazil (Matto Grosso) and Bolivia (La Paz). The western penetration of the genus extends as far as Peru (Huanuco) and Ecuador (Tungurahua).

Description.—Size small for the subfamily; surface granulose. Vertex narrow, interocular width equal to or slightly greater than the width of one of the eyes in females, in males equal to less than the width of one of the eyes. Fastigium truncate, on a line with the anterior border of the eyes or slightly behind such a line; frontal carina greatly reduced, obsolete for at least the median two-thirds of its length. Frontal costa protrusive in profile, its lateral carinae cristate, narrowly and deeply sulcate between. (The aberrant frontal costa of *R. mendosum* n. sp. is not considered here. For discussion see p. 104.) Eyes proportionately very large; globose; very protrusive. Antennae filiform, elongate, 21 segmented. Pronotum tectate; median carina percurrent, cristate; lateral carinae subobsolete; in lateral outline rising anteriorly, or substraight; terminating anteriorly in a pronounced spinous process which is decurved; usually brachypronotal; tegmina and tegminal sinuses present or absent; tegmina maculate or immaculate. Median femora with internal, dorso-apical spine. Posterior femora subgracile to moderately incrassate; distal tarsal element equal to or slightly longer than the two proximal articles combined. Female subgenital plate entire, its apical border parabolic in outline in ventral aspect. Ovipositor valves short and broad. Male ninth abdominal sternite with apical margin entire or emarginate.

Genotype, *Rehnidium omnivagum* n. sp.

This genus is named in honor of my friend and colleague Mr. James A. G. Rehn, on the occasion of his 75th birthday and 56th year of distinguished service to systematic biology.

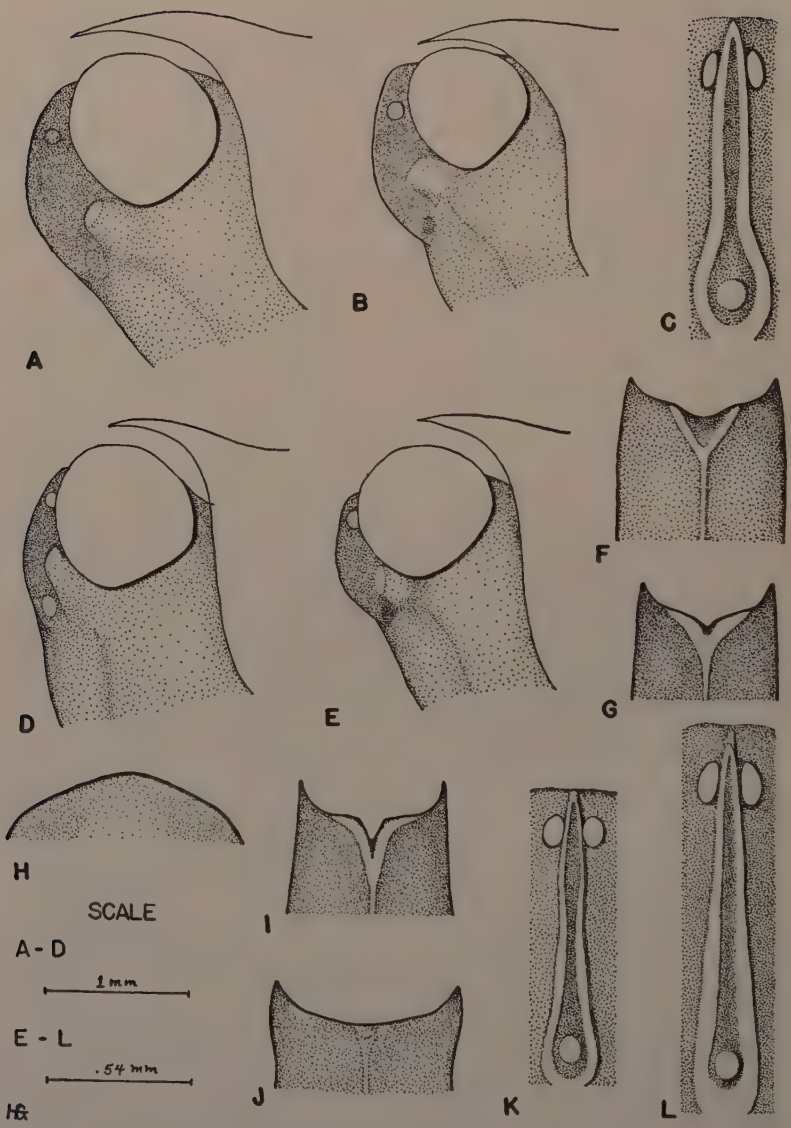


Fig. 4.—Taxonomic characters of the species of *Rehnidium* n. g. A, head, left lateral aspect, ♀, type, *R. necopinum* n. sp.; B, the same of, ♀, type, *R. omnivagum* n. sp.; C, frontal costa, frontal aspect, ♀, type, *R. omnivagum* n. sp.; D, head, left lateral aspect, ♂, type, *R. mendosum* n. sp.;

Key to the Species of Rehnidium

1. Tegmina and tegminal sinuses absent; pronotum highly tectate; surface coarsely granulose; ventro-apical border of ninth abdominal sternite as figured (Fig. 4, F) ..... *R. necopinum* n. sp.
   Tegmina and tegminal sinuses present; pronotum weakly or moderately tectate; surface finely granulose 2
2. Tegmina maculate 3
   Tegmina immaculate 4
3. Pronotum in outline rising sharply before shoulders and over head; tegminal maculation large, irregularly shaped, confluent with ventro-apical border; ventro-apical border of ninth abdominal sternite as figured (Fig. 5, B) ..... *R. verutum* n. sp.
   Pronotum rising weakly anteriorly; tegminal maculation small, circular in outline, remote from ventro-apical border; ventro-apical border of ninth abdominal sternite as figured (Fig. 4, J), (based on male only). *R. mendosum* n. sp.
4. Lateral carinae of frontal costa moderately divergent; posterior femora less than 3.5 times longer than broad; ventro-apical border of ninth abdominal sternite as figured (Fig. 4, H) ..... *R. omnivagum* n. sp.
   Lateral carinae of frontal costa rather closely appressed; posterior femora more than 3.5 times longer than broad; ventro-apical border of ninth abdominal sternite as figured (Fig. 4, I), (based on male only) ..... *R. perexiguum* n. sp.

Rehnidium omnivagum n. sp. Plate XVI, figs. 1, 2.

Diagnosis.—This form is closely related to *R. perexiguum* n. sp. but differs from it in the profile of the frontal costa as noted in the diagnosis of that species (see p. 102). It also has less cristate, more divergent lateral carinae of the frontal costa and more markedly incrassate caudal femora. From *R. necopinum* n. sp. it differs in the possession of tegmina and tegminal sinuses and from *R. mendosum* n. sp. and *R. verutum* n. sp. it may be segregated on the basis of its maculate tegmina.

(*Cont. legend from opposite page.*)
E, the same of, ♂, type, *R. perexiguum* n. sp.; F, ninth abdominal sternite, apical portion, ventral aspect, ♂, allotype, *R. necopinum* n. sp.; G, the same of, ♂, allotype, *R. omnivagum* n. sp.; H, subgenital plate, apical portion, ventral aspect, ♀, type, *R. omnivagum* n. sp.; I, ninth abdominal sternite, apical portion, ventral aspect, ♂, type, *R. perexiguum* n. sp.; J, the same of, ♀, type, *R. mendosum* n. sp.; K, frontal costa, frontal aspect, ♂, type, *R. perexiguum* n. sp.; L, the same of, ♀, type, *R. necopinum* n. sp.

Type. ♀, Santa Rosa de Descalvados, Matto Grosso, Brazil, 16-VII-1931 (Matto Grosso Expedition; J. A. G. Rehn). [Acad. Nat. Sci. Phila. Type no. 5898.]

Description; stature and surface.—Size average for the genus; form subrobust; surface granulose, the granules about the size of those in *R. perexiguum* n. sp., but not so widely scattered.

Head.—Interocular width of vertex about 1.1 times the width of one of the eyes; fastigium, from above, truncate, on a line with the anterior border of the eyes; anterior fastigial carina present as small latero-frontal, convex, carinulae; longitudinal fossulae mesad of eyes relatively shallow; supraocular lobes prominent, somewhat raised. In lateral aspect, dorsal surface of the vertex beneath that of the eyes; fastigium, in this aspect, with its median portion barely visible; frontal costa, in outline, obtusely angulate at dorsal terminus, anteriorly lowly arcuate, advanced before the anterior border of the eyes a distance equal to one-third the width of one of them in lateral aspect (Fig. 4, B). Face retreating in profile. Vertex, in frontal aspect, slightly lower than the dorsal surface of the eyes anteriorly, behind this rising slightly; latero-frontal carinulae oblique in frontal aspect, their ectal extremities slightly higher; restricted to latero-frontal angles of fastigium. Frontal costa, seen anteriorly, with the dorsal terminus just below the dorsal border of the eyes; with subcristate, divergent, lateral carinae which are subparallel for four-fifths of their ventral descent, thence flaring outwards just before reaching the median ocellus (Fig. 4, C). Eyes prominent, subglobose in lateral aspect. Antennae missing in type.

Pronotum.—Moderately tectate; median carina percurrent, cristate; terminating anteriorly in a strong, moderately decurved, spinous process which falls just short of reaching the fastigium; terminating posteriorly in an acute apical process; brachypronotal, the pronotum terminating anterior of the knees a distance equal to one-quarter the length of a posterior femur. In lateral aspect, the dorsal outline rises anteriorly from a point midway in its length; anterior carinae subobsolete; prozonal sulcus weak; scapular area elongate, dorsally convexed. Lateral lobes, in lateral aspect, with both sinuses strongly developed, inferior sinus obtusely angulate; posterior border beneath the inferior sinus slightly convexed. Tegmina prominent, ovoid. Anterior pronotal carinae, from above, barely visible, posteriorly divergent, slightly concave. Lateral lobes, from above, moderately flared, the distance between their caudo-ventral angles equal to 32 percent of the length of the pronotum.

Legs.—Anterior femora weakly sulcate above for their entire lengths. Median femora very strongly sulcate above for their entire lengths; proportionately shorter than *R. perexiguum* n. sp.; with a sharp, thin, internal, dorso-apical spine. Posterior femora incrassate, 2.8 times longer than broad; distal article of posterior tarsus distinctly longer than the length of the proximal two articles combined; all pulvilli of posterior tarsus approximately equal in length.

Coloration.—Dorsal surface of pronotum and legs earth brown, mottled with fuscous. Dorsal surface of vertex: face above the antennal insertions, eyes, and upper two-thirds of pronotal lateral lobes fuscous, mottled with earth brown. Face below the antennal insertions and lower third of pronotal lateral lobes dirty yellow, "marbled" with fuscous brown.

Measurements.—Total body length (face to tip of ovipositor), 8.2 mm; length of pronotum, 7.1 mm; depth of pronotum (dorsal surface of median carina to ventral border of lateral lobe), 2.0 mm; interocular width of vertex, .6 mm; length of posterior femur, 5.2 mm; greatest breadth of posterior femur, 1.8 mm.

Allotype. ♂, same data as type. [Acad. Nat. Sci. Phila.]

The male allotype differs from the type in the characters mentioned below.

Head.—Interocular width of vertex equal to the width of one of the eyes; fastigium not reaching anteriorly as far as the anterior border of the eyes, its latero-frontal carinulae more reduced, visible on ectal border only; longitudinal fossulae medad of eyes obsolete. Fastigium not visible in lateral aspect; frontal costa advanced before the anterior border of the eyes for a distance less than one-quarter the width of one of them in lateral aspect. Vertex, in frontal aspect, lower and flatter; frontal costa in same view, with its lateral carinae slightly flared above the antennal insertions. Eyes more prominent. Antennae filiform, elongate, about one and three-quarter times the dorso-ventral length of the head; 21 segmented.

Pronotum.—More lowly tectate; in dorsal aspect, rising sharply anteriorly; prozonal sulcus stronger; distance between caudo ventral angles of lateral lobes equal to one-third the length of the pronotum.

Abdomen.—Ninth abdominal sternite as figured (Fig. 4, G).

Measurements.—Total body length (face to tip of abdomen), 7.0 mm; length of pronotum, 6.6 mm; depth of pronotum (dorsal surface of median carina to ventral border of lateral lobe), 1.7 mm; interocular width of vertex, .5 mm; length of posterior femur, 4.8 mm; greatest breadth of posterior femur, 1.6 mm.

Paratypes (19; 4 ♂, 15 ♀).

VENEZUELA: Rio Caipe, E. of Barinas, Barinas, I-1943 (Pablo Anduze), 3 ♂, 1 ♀ [A.N.S.P.].

DUTCH GUIANA: Paramaribo (K. Mayo), 1 ♂, 2 ♀ [A.N.S.P.]; Moengo, Boven Cottica River, 15-IV-1927 (Cornell University Exp., lot 760, sub 58), 1 ♀ [A.N.S.P.].

PERU: Pachitea, Huanuco, 1 ♀ [A.N.S.P.]; Iberia, Madre de Dios,[4] 30-IV-1947, altitude 500 ft. (J. C. Pallister, 1 ♀ [A.M.N.H.].

[4] I am indebted to Mr. J. C. Pallister of the American Museum of Natural History for this locality datum.

Bolivia: Cavinas, Beni, II-1922 (Wm. Mann, M. R. Lopez), 2 ♀ [U.S.N.M.]; Covendo, La Paz, VIII-1921 (Wm. Mann), 2 ♀ [U.S.N.M.].

Brazil: Pará, IX, 1 ♀ [C.M.]; Chapada, Matto Grosso, VI, VIII, XI, 3 ♀ [C.M.]. (These four specimens were recorded by Bruner, 1910, as paratypes of his *Tettigidea gracilicornis*.) Same data as type, 1 ♀ [A.N.S.P.].

Locality	Sex	Interocular Width	Vertex / Eye Ratio	Pronotal Length
Venezuela	♀	.67	1.3	8.3
Caipe	♂	.45	1.1	6.0
		.45	1.0	6.2
		.50	1.0	6.3
Dutch Guiana				
Paramaribo	♀	.65	1.3	8.7
and Moengo		.65	1.2	8.7
		.67	1.3	7.6
	♂	.52	1.1	7.0
Peru				
Iberia	♀	.65	1.3	10.0 (Macropronotal)
Pachitea	♀	.62	1.3	9.6 (Macropronotal)
Bolivia				
Cavinas	♀	.65	1.4	7.8
		.70	1.3	10.7 (Macropronotal)
Covendo	♀	.70	1.4	8.6
		.70	1.4	8.2
Brazil				
Para	♀	.70	1.3	8.6
Chapada	♀	.67	1.3	8.7
		.67	1.2	8.3
		.72	1.5	9.0
Descalvados	♀	.60	1.2	8.0
		.60 (type)	1.3	7.1
	♂	.47 (allotype)	1.0	6.6

Table 3.—Size variation in the type series of *Rehnidium omnivagum* n. sp. All measurements in millimeters.

Variation and discussion.—The species exhibits moderate stability in its morphology over the entire area of its rather wide distribution. While variations are evident the localities represented are so separated and the series so small that I regard it as unwise to name the various populations which seem to segregate.

Future collections alone can clarify the relationships of the far-flung populations, some of which are probably subspecies. However, there exists, in my opinion, no question as to the conspecificity of the specimens herein recorded.

The interocular width of the vertex is variable, as indicated in table 3, with the extremes being .60 to .72 mm in females and .45 to .52 mm in males. The ratio of the interocular width of the vertex to the width of the eye $\left(\frac{\text{vertex}}{\text{eye}}\right)$ varies from 1.2 to 1.5 in females and from 1.0 to 1.1 in males (see table 3). Variation in actual size, as indicated by pronotal lengths, varies from 7.6 to 9.0 mm in brachypronotal females, and from 6.0 to 7.0 mm in short pronotum males. The majority of specimens are of the brachypronotal type, but three females (Iberia and Pachitea, Peru, and Cavinas, Bolivia) have the long pronotum. The pronotal lengths of these specimens are recorded in table 3.

The dorsal terminus of the frontal costa, in lateral aspect, varies from an angle of approximately 90° in the majority of specimens to a slightly obtuse angle in the Caipe, Venezuela series.

Minor variations appear in the condition of the pronotal surface which occasionally has somewhat larger granules, and in the robustness of the internal, dorso-apical spine of the median femora which may be short and heavy or rather thin and moderately long.

The antennal count in both sexes is 21 segments.

Distribution.—This species is the most widespread of the genus, being found in the lowlands of the Amazonian and Oronoco basins and on the northeastern coast between the deltas of these two rivers. At no point is the species known from an altitude of over 1500 feet and even this is recorded from but one locality (Chapada, Brazil) which is within a few miles of lowland jungle with an altitude of 300 feet. Elsewhere the species is found at very low altitudes and under floristic and climatic conditions which are generally similar. The following map (Fig. 6) shows this distribution.

Rehnidium verutum n. sp. Text-fig. 5, A.

Diagnosis.—This species is distinguished by its less tectate pronotum, sharply rising anterior uncinate process which is higher than any of those found among its congeners and by the cristate, very closely appressed lateral carinae of the frontal costa. It is closely related to *R. omnivagum* n. sp., and *R. perexiguum* n. sp. From both of these it differs in being larger in size and in possessing maculate tegmina. From *R. mendosum* n. sp., to which it is less closely related, it can be separated by the form of the apex of the ninth sternite in males, and from *R. necopinum* n. sp. it differs in possessing tegmina.

Type. ♀, Puerto Bermudez, Rio Pichis, Junín, Peru, 12-19-VII-1920 (Cornell Univ. Exp.). [Acad. Nat. Sci. Phila. Type no. 5899.]

Description; stature and surface.—Size large for the genus; form subgracile; surface finely granulose.

Head.—Interocular width of vertex equal to .9 the width of one of the eyes; fastigium, from above, not reaching anterior border of eyes, truncate, anterior carina obsolete in median third, present on latero-frontal angles. Supra-ocular lobes prominent. Longitudinal fossulae mesad of eyes moderately deep and developed. From above, dorsal terminus of frontal costa projects posteriorly on dorsal surface of vertex. Vertex, as seen laterally, lower than the dorsal surface of the eyes. Frontal costa, in lateral aspect, protrusive, slightly arched in profile, dorsal terminus obtusely rounded (Fig. 5, C). Face retreating in profile. Vertex, in frontal aspect, shallowly concave; latero-frontal carinulae of fastigium rising sharply dorsad at their lateral extremities. Frontal costa, in frontal aspect, with cristate lateral carinae which are rather closely appressed, deeply sulcate between (Fig. 5, D). Eyes prominent, large, globose. Antennae elongate, about twice the dorso-ventral length of the head, filiform, 22 segmented.

Pronotum.—Very lowly tectate; with percurrent, cristate, median carina; terminating in a spinous, decurved, anterior process which is arched over the head and reaches halfway to the fastigium; posterior apical process truncate. Macropronotal, but exceeding the knees only slightly. In lateral aspect, the dorsal uncinate process rises rather sharply over the head. Anterior carinae weak, straight, slightly divergent posteriorly. Lateral lobes with pronounced tegminal and inferior sinuses. Tegmina prominent, ventro-apically maculate.

Legs.—Anterior femora slightly elongate, clearly sulcate above for their entire lengths. Median femora elongate; more deeply sulcate above; with a well-developed, internal, dorso-apical spine. Posterior femora subrobust, about 3.3 times longer than broad; distal article of posterior tarsus about

equal in length to length of two proximal articles combined; pulvilli enlarging in proximal to distal sequence.

Abdomen.—Subgenital plate slightly sharper at apex of median projection than in other species of the genus.

Coloration.—Ground color of entire body light sandy brown. Occiput behind eyes, upper half of lateral pronotal lobes, and median area of paginae a dark fuscous brown.

Measurements.—Total body length (face to tip of ovipositor), 8.6 mm; length of pronotum, 10.9 mm; depth of pronotum (dorsal surface of median carina to ventral border of lateral lobes), 2.0 mm; interocular width of vertex, .62 mm; length of posterior femur, 6.5 mm; greatest breadth of posterior femur, 1.9 mm.

Allotype. ♂, Upper Rio Pachitea, Huanuco, Peru, 21-VII-1920 (Cornell Univ. Exp.). [Acad. Nat. Sci. Phila.]

The allotype differs from the type in the following respects.

Head.—Interocular width of vertex equal to .8 the width of one of the eyes. Fastigium, from above, not proceeding as far anteriorly as in the type; longitudinal fossulae mesad of eyes shallow, poorly developed. Frontal costa, in lateral aspect slightly less protrusive; in frontal aspect, lateral carinae more cristate, closer together. Vertex, in frontal aspect, more deeply concave. Eyes more protrusive.

Pronotum.—Median carina cristate in anterior three-quarters of length, subobsolete in posterior quarter.

Abdomen.—Ninth abdominal sternite as figured (Fig. 5, B).

Measurements.—Total body length (face to tip of abdomen), 7.3 mm; length of pronotum, 8.9 mm; depth of pronotum (dorsal surface of median carina to ventral border of lateral lobes), 1.4 mm; interocular width of vertex, .5 mm; length of posterior femur, 5.4 mm; greatest breadth of posterior femur, 1.6 mm.

Variation and discussion.—The type series exhibits variation in the cristate median carina of the pronotum which is only weakly developed in its posterior third in the type, but is well marked in one of the Pachitea females. The color is also variable, being darker in its lighter areas, but always having the darker lateral streak. In distribution the species is known only from Peru and has its range indicated on the accompanying map (Fig. 6).

Paratypes (7; 2 ♀, 5 ♂).

PERU: Pachitea, Huanuco, 2 ♀, 4 ♂ [A.N.S.P.]; Monson Valley, Tingo Maria, Huanuco, 23-IX-1954 (E. I. Schlinger and E. S. Ross), 1 ♂ [C.A.].

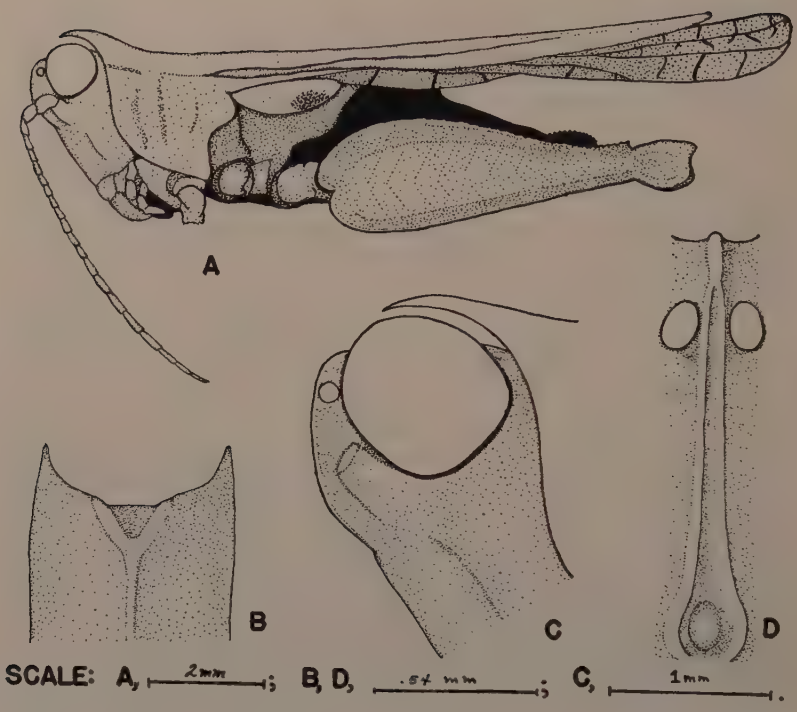


Fig. 5.—Taxonomic characters of *Rehnidium verutum* n. sp. A, left lateral aspect, ♀, type; B, ninth abdominal sternite, apical portion, ventral aspect, ♂, allotype; C, head, left lateral aspect, ♀, type; D, frontal costa, frontal aspect, ♀, type.

Rehnidium perexiguum n. sp. Plate XVI, fig. 4.

Diagnosis.—This taxon differs from others of the genus with which it might be confused by possessing more elongate median femora and a rounded dorsal terminus of the frontal costa in profile. From *R. necopinum* n. sp. it differs in possessing tegmina and tegminal sinuses and the more finely granulose pronotal surface. From *R. mendosum* n. sp. it may be recognized by its smaller stature, smaller tegmina and more prominent eyes. It differs from *R. verutum* n. sp. in possessing immaculate tegmina.

Type. ♂, Baños, Tungurahua, Ecuador, IX-1938 (Wm. Clarke-MacIntyre), 1800 meters. [Acad. Nat. Sci. Phila. Type no. 5900.]

Description; stature and surface.—Size small for the genus; form subgracile; surface granulose, the granules smooth and widely scattered.

Head.—Interocular width of vertex equal to .9 the width of one of the eyes; fastigium, from above, not reaching the anterior border of the eyes, truncate, its anterior carina obsolete, present only on the lateral angles. Supra-ocular lobes prominent; longitudinal fossulae mesad of eyes weak. Dorsal terminus of frontal costa, from above, encroaching upon the vertex in its anterior extremity. Vertex, in lateral aspect, with its dorsal surface lower than that of the eyes; fastigium, in this aspect, invisible; frontal costa sloping off from vertex, obtusely angulate above paired ocelli, thence lowly arcuate ventrad, protruding before the eyes a distance equal to one-quarter the width of one of them as seen laterally (Fig. 4, E). Face retreating strongly in profile. Vertex, in frontal aspect, appearing slightly concave, its dorsal surface below that of the eyes; latero-frontal carinulae of fastigium directed dorso-ectad along the mesal borders of the eyes and rising above the dorsal surface of the vertex. Frontal costa, in frontal aspect, with cristate lateral carinae which are weakly divergent dorsad, concave between the antennal insertions and weakly flared beneath this; deeply, but narrowly sulcate between (Fig. 4, K). Eyes very prominent, almost perfectly globose in lateral and frontal aspects; antennae missing in type.

Pronotum.—Lowly tectate; with a percurrent, cristate, median carina; terminating in an anterior spinous process which is slightly decurved and which proceeds anteriorly as far as the supra-ocular lobes; posterior apical process acuminate; brachypronotal, the apical process terminating anterior to the knees a distance equal to about one-third the length of a posterior femur. In lateral aspect, the dorsal surface is weakly upcurved anteriorly, the spinous process extending over the head; anterior carina weak, but evident; scapular area elongate and narrow. Lateral lobes, in lateral aspect, with acutely angulate tegminal sinuses; inferior sinus obtusely angulate; posterior border, below inferior sinus, convexed. Tegmina prominent, elongate. Anterior pronotal carinae from above, evenly concave; lateral lobes weakly flared, distance between their caudo-ventral angles equal to one-third the length of the pronotum.

Legs.—Anterior femora very weakly sulcate above in proximal three-quarters of their lengths only. Median femora moderately sulcate above for entire lengths; moderately elongate, with a thin, sharp, internal dorso-apical spine. Posterior femora subgracile, about 3.5 times longer than broad; distal article of posterior tarsus slightly longer than the proximal two articles combined; pulvilli of posterior tarsus enlarging in proximal to distal sequence.

Abdomen.—Ninth abdominal sternite as in fig. 4, I.

Coloration.—Dorsal pronotal surface and eyes, a light earth brown; face above the antennal insertions and below the fastigium, area of head behind the eyes, lateral lobes of pronotum in upper two-thirds and tegmina, black;

vertex, face below the antennal insertions and lower one-third of pronotal lateral lobes, dirty yellow; legs a light brown.

Measurements.—Total body length (face to tip of abdomen), 7.1 mm; length of pronotum, 6.0 mm; depth of pronotum (dorsal surface of median carina to ventral border of lateral lobes), 1.4 mm; interocular width of vertex, .5 mm; length of posterior femur, 5.2 mm; greatest breadth of posterior femur, 1.4 mm.

The type of the species is unique.

Rehnidium mendosum n. sp. Plate XVI, fig. 3.

Diagnosis.—This species differs from its congeners in possessing larger and deeper tegmina, which are apically maculate, and in having shorter antennae, these being scarcely longer than the dorso-ventral length of the head. In addition, the facial profile is distinctive in that the frontal costa is lowly arched with no apparent angulation at its dorsal terminus. The ninth abdominal sternite of the male lacks the medio-apical emargination found in other species of the genus.

Type. ♂, Tingo Maria, Monson Valley, Huanuco, Peru, 2-XI-1954 (E. I. Schlinger and E. S. Ross). [C. A.]

Description; stature and surface.—Size and form typical for the genus; surface granulose, the granules of the size and form found in *R. necopinum* n. sp., but being less widely scattered than in that species; occasional larger pustules on pronotum and legs.

Head.—Interocular width of vertex equal to .8 the width of one of the eyes; fastigium, from above, truncate, not advanced as far as the anterior border of the eyes; frontal carina of fastigium absent, lateral carinulae only present. Supra-ocular lobes somewhat reduced; longitudinal fossulae mesad of eyes obsolete. Vertex, in lateral aspect, with its dorsal surface lower than the dorsal border of the eyes; fastigium not visible in this aspect; frontal costa low arcuate, its dorsal terminus just visible in lateral aspect, very obtusely angulate rounded; frontal costa advanced before the eyes a distance equal to one-quarter the width of one of them in lateral aspect (Fig. 4, D). Face very weakly retreating in profile. Vertex, in frontal aspect, flattened, anteriorly weakly concave; lateral carinae of frontal costa evenly diverging in dorsal quarter. (The frontal costa of the type has either been injured during the specimen's ontogeny or is teratological; the right ramus is inflated and the sulcus between the rami is virtually eliminated. For this reason, I have disregarded the morphology of the lateral carinae and the sulcus as characters in separating this taxon from the others of the genus.) Latero-frontal carinulae of fastigium with their ectal extremities higher than the mesal ones. Eyes prominent, sub-globose in

lateral aspect. Antennae short, filiform, about one and one-quarter times longer than the head; 21 segmented.

Pronotum.—Rather lowly tectate; median carina percurrent, moderately cristate; terminating anteriorly in a fine, weakly decurved, spinous process; terminating posteriorly in an acute, decurved, apical process; brachypronotal, the pronotum terminating anterior to the knees a distance equal to one-quarter the length of a posterior femur. Pronotal outline, in lateral aspect, sinuate, rising above the head sharply, apical process decurved; anterior carinae weak; prozonal sulcus only moderately defined; scapular area elongate, narrow, dorsally arched. Lateral lobes, in lateral aspect, with very obtusely angulate inferior sinus, posterior border beneath this straight. Tegmina large, distally maculate. Anterior pronotal carinae substraight, divergent in dorsal aspect. Caudo-ventral angles of lateral lobes, from above, distinctly splayed, the angles acute; distance between caudo-ventral angles of lateral lobes equal to one-third the length of the pronotum.

Legs.—Anterior femora with obsolete sulcus above, the sulcation barely indicated in the proximal fifth of their lengths; somewhat inflated. Median femora sulcate above throughout their entire lengths, the sulcus shallow; internal, dorso-apical spine short, blunt, decurved. Posterior femora subgracile, about 3.5 times longer than broad; distal article of posterior tarsus approximately equal in length to the combined lengths of the two proximal articles; all pulvilli of posterior metatarsus approximately equal in length.

Abdomen.—Ninth abdominal sternite as in fig. 4, J.

Coloration.—Dorsal surface of pronotum, vertex, anterior and median femora, earth brown; eyes chestnut brown; face above antennal insertions, fuscous-brown; gena behind eyes with a broad fuscous streak; upper two-thirds of lateral lobes and posterior femora, fuscous; lower third of pronotal lateral lobes, dirty cream; tegmina fuscous with a tiny, light brown, apical macula.

Measurements.—Length of pronotum, 8.0 mm; depth of pronotum (dorsal surface of median carina to ventral border of lateral lobe), 2.1 mm; interocular width of vertex, .5 mm; length of posterior femur, 5.5 mm; greatest breadth of posterior femur, 1.5 mm.

The type is unique.

Rehnidium necopinum n. sp. Plate XVI, figs. 5, 6.

Diagnosis.—The species differs from others of the genus in lacking wings, tegmina and tegminal sinuses. Its pronotum is also more highly tectate, the anterior spinous process of the pronotum is proportionately longer than in its congeners and the frontal costa, in lateral aspect, is more rounded in the fastigiofacial angle. This taxon is rather distantly related to the others of the genus and is very easily differentiated from them on the basis of the foregoing characters.

Type. ♀, Marcapata, Madre de Dios, Peru. [Acad. Nat. Sci. Phila. Type no. 5901.]

Description; stature and surface.—Size large for the genus; form robust; surface coarsely granulose, the granules widely scattered.

Head.—Interocular width of vertex equal to the width of one of the eyes; fastigium, from above, advanced to the anterior border of the eyes, anteriorly truncate; anterior carina reduced to latero-frontal carinulae which are anteriorly convexed. Supra-ocular lobes small, prominent; longitudinal fossulae of vertex well developed. In lateral aspect, the vertex is lower than the dorsal border of the eyes; fastigium not visible in this aspect; frontal costa approximately rounded from the vertex to the paired ocelli; low arcuate; protruding before the eyes a distance equal to about one-quarter the width of one of them in lateral aspect (Fig. 4, A). Face retreating in profile. Vertex, in frontal aspect, somewhat domed; latero-frontal carinae of fastigium very small, and restricted to the ectal angles of the fastigium. Frontal costa, in frontal aspect, with evenly diverging lateral carinae which are deeply sulcate between (Fig. 4, L). Eyes prominent, globose in lateral aspect. Antennae elongate, twice the dorso-ventral length of the head; 21 segmented.

Pronotum.—Highly tectate; with percurrent, cristate median carina; anteriorly terminating in a strong, slightly decurved, spinous process which does not quite reach the fastigium; posteriorly terminating in a very narrowly truncate apical process; brachypronotal, the pronotum terminating anterior to the knees a distance equal to one-third the length of a posterior femur. In lateral aspect, the pronotal outline is almost straight; anterior carinae subobsolete; with a pronounced prozonal sulcus; scapular area broad, xiphoid in outline. Lateral lobes, in lateral aspect, with an obtusely angulate inferior sinus; posterior border straight. Anterior pronotal carinae, from above, straight, weakly divergent. Lateral lobes, from above, moderately flared, distance between caudo-ventral angles of lateral lobes equal to about ⅔ the length of the pronotum.

Legs.—Anterior femora weakly sulcate above for entire lengths. Median femora more strongly sulcate above for entire lengths; moderately elongate; with a strong, internal, dorso-apical spine. Posterior femora moderately incrassate, about 3.2 times longer than broad; distal article of posterior tarsus slightly longer than the proximal two articles combined; all pulvilli of posterior metatarsus of equal length.

Coloration.—Dorsal surface of pronotum, anterior and median legs, light brown. Vertex, face above the antennal insertions, eyes, upper two-thirds of lateral lobes and scapular area fuscous-black. Face below the antennal insertions and lower third of lateral lobes dark cream color. Geniculae of posterior limbs and median distal area of paginae fuscous.

Measurements.—Total body length (face to tip of ovipositor), 11.2 mm; length of pronotum, 9.4 mm; depth of pronotum (dorsal surface of median carina to ventral border of lateral lobe), 2.5 mm; interocular width of

Fig. 6.—Map showing the distribution of *Rehniithum* n. g. Open circle, *R. perexiguum* n. sp.; filled circles, *R. omnivagum* n. sp.; circle with lower half filled, *R. necopinum* n. sp.; circle with right half filled, *R. mendosum* n. sp.; circles with cross, *R. verutum* n. sp.

vertex, .7 mm; length of posterior femur, 6.8 mm; greatest breadth of posterior femur, 2.1 mm.

Allotype. ♂, same data as type. [Acad. Nat. Sci. Phila.]

The allotypic male differs from the type in the following respects.

Head.—Interocular width of vertex equal to .9 the width of one of the eyes; fastigium, from above, not reaching the anterior border of the eyes. Frontal costa, in lateral aspect, projecting before the eyes a distance less than one-quarter the width of one of them in lateral aspect. Vertex, in frontal aspect, flattened on its dorsal surface. Eyes very prominent; antennae more elongate, slightly longer than twice the length of the head.

Pronotum.—More lowly tectate; anterior spinous process terminating well behind the fastigium; posterior apical process acuminate.

Abdomen.—Ninth abdominal sternite as figured (Fig. 4, F).

Measurements.—Total body length (face to tip of abdomen), 8.7 mm; length of pronotum, 7.1 mm; depth of pronotum (dorsal surface of median carina to ventral border of lateral lobe), 1.7 mm; interocular width of vertex, .5 mm; length of posterior femur, 5.6 mm; greatest breadth of posterior femur, 1.6 mm.

Paratype; "Bolivia," 1 ♂ [A.N.S.P.].

Explanation of Plates

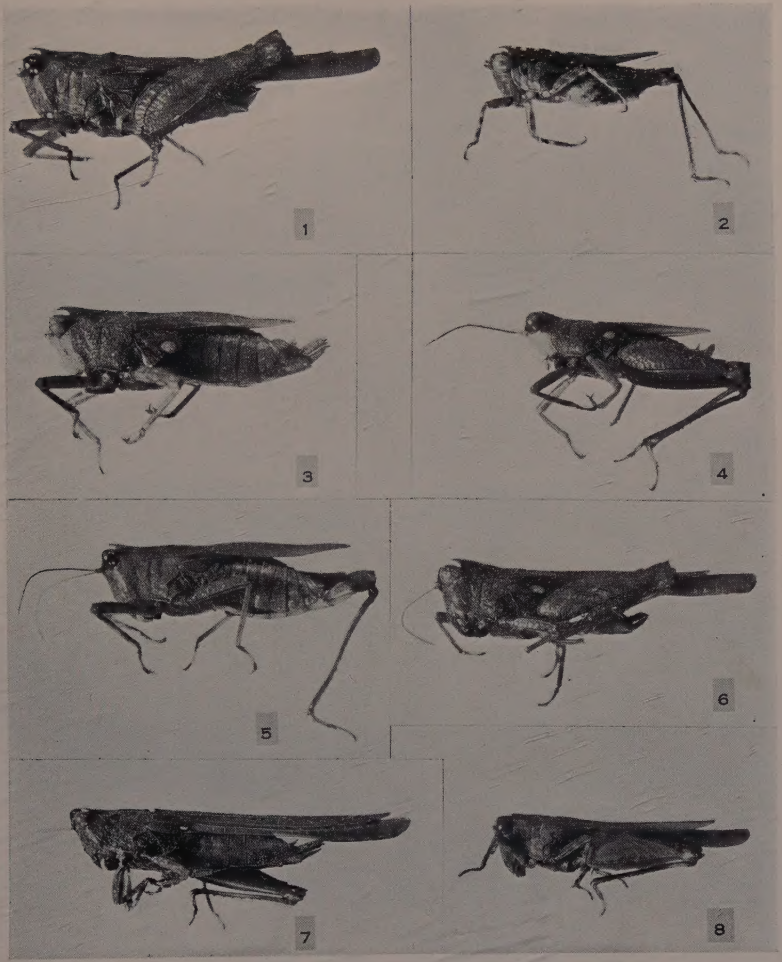
(All figures greatly enlarged)

Plate XV

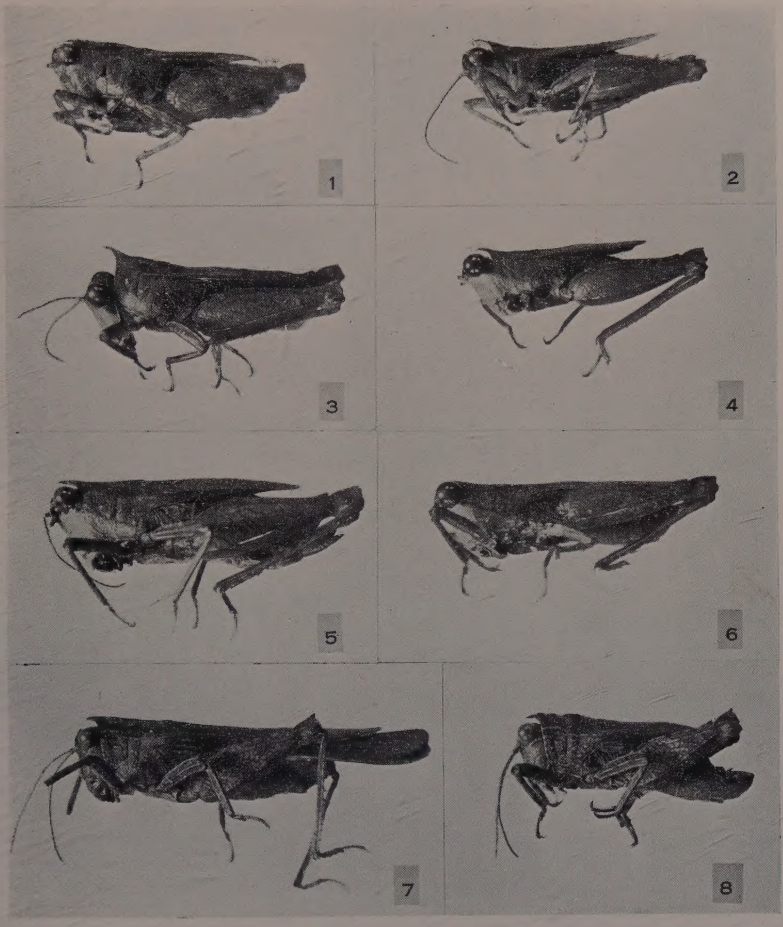
Fig. 1.—*Batrachidea mucronata,* left lateral aspect, ♀.
Fig. 2.—*Batrachidea vesca* n. sp., left lateral aspect, ♂ *type.*
Fig. 3.—*Batrachidea flavonotata,* left lateral aspect, ♀ *lectoallotype.*
Fig. 4.—*Batrachidea flavonotata,* left lateral aspect, ♂ *lectotype.*
Fig. 5.—*Batrachidea inermis,* left lateral aspect, ♀ *type.*
Fig. 6.—*Batrachidea macella* n. sp., left lateral aspect, ♀ *type.*
Fig. 7.—*Lophoscirtus gracilis,* left lateral aspect, ♀ *type.*
Fig. 8.—*Eutettigidea lineata,* left lateral aspect, ♀ *lectotype.*

Plate XVI

Fig. 1.—*Rehnidium omnivagum* n. sp., left lateral aspect, ♀ *type.*
Fig. 2.—*Rehnidium omnivagum* n. sp., left lateral aspect, ♂ *allotype.*
Fig. 3.—*Rehnidium mendosum* n. sp., left lateral aspect, ♂ *type.*
Fig. 4.—*Rehnidium perexiguum* n. sp., left lateral aspect, ♂ *type.*
Fig. 5.—*Rehnidium necopinum* n. sp., left lateral aspect, ♀ *type.*
Fig. 6.—*Rehnidium necopinum* n. sp., left lateral aspect, ♂ *allotype.*
Fig. 7.—*Puiggaria antennata,* left lateral aspect, ♀.
Fig. 8.—*Puiggaria antennata,* left lateral aspect, ♂ *allotype.*



GRANT: TAXONOMY OF BATRACHIDEA



GRANT: TAXONOMY OF BATRACHIDEA